SCIENCE.

FRIDAY, SEPTEMBER 21, 1883.

THE U. S. SIGNAL SERVICE.

II.

IT must be said that the annual report would be vastly improved by being made either one thing or the other, or, better, two separate things. At present it is at once a *résumé* of meteorological work done during the year, and a government blue-book. As the former, it falls far short, not of the ideal, but of the possible: it is probably equally deficient considered as the latter. It is certainly desirable that the summarized results of such great labor, comprehending so vast a field, should be published annually in such a form as to be useful to those who are engaged in meteorological study and research, and it ought to be done with reasonable promptness.

The size of the volume might be reduced to at least one-half of what it is at present, and that without material loss. The report proper of the chief signal officer ought to be rewritten; and it does not seem too much to ask that it be prepared afresh every year, and that it should be confined to a statement and discussion of the actual progress made during the year. Expensive reprinting is a luxury that only government offices can afford to indulge in, and it is sometimes carried to an extent that is not only wasteful, but positively objectionable. A large portion of this annual report is made up of a republication of the monthly weather-reviews for the year. These have already been printed and circulated among those to whom they would be useful. Another large part consists of material already printed and circulated as 'Instructions to observers,' and might well be dispensed with here. The 'annual meteorological summary,' occupying about one-fourth of the volume, is susceptible of considerable condensation without loss of value to the student of meteorology. Many of the appendices are made up entirely of matter which is, of itself, not without value, and which may well be kept on file and accessible at the central office, but which is entirely without interest or value to the majority of those into whose hands this report is intended to fall. A much smaller volume, embodying the real meteorological work of the year, with such discussions thereof as could be given, as everybody knows, by persons in the employ of the government at the central office, would be welcomed everywhere, and would be a real boon to students. As at present issued, the report is unmanageable, uninviting, and unsatisfactory.

As already intimated, the report for 1881 contains evidence of some important changes in the organization of the central office, and in the general policy of the service. It seems now to be recognized, that meteorology is, or will be, a *science*, and that it is wisdom on the part of the government to secure the cooperation of scientific men in the work which it has undertaken, as well as to employ an important portion of its own staff in the investigation of meteorological problems, and the carrying-on of special researches. This is a step which, although tardy, will be highly appreciated.

Among the most tangible results thus far may be mentioned the permanent establishment of a 'scientific and study division.' The wisdom of placing this entirely under the control of Professor Abbé, and of permitting him to select his own assistants, cannot be too highly commended. His selection of Messrs. Upton, Hazen, and Waldo for this important service has been justified by the numerous valuable contributions which they have already made under his direction. The transfer of Professor Ferrel from the coast survey to the meteorological bureau is another step in the same direction, which is likely to materially increase the strength of the division. In many other directions, the chief signal officer has shown his appreciation of the 'eternal fitness of things.' He has sought and obtained the cooperation of the National academy, in the

appointment of a permanent committee of that body to which he may refer such questions concerning meteorological science as may seem desirable. He has inaugurated the custom of consulting specialists upon various matters pertaining to the service, and has shown a disposition to aid scientific research in all matters related to meteorology, as instanced in Professor Langley's expedition to Mount Whitney, in the offer to the coast-survey of cooperation in the making of pendulum-observations, and in the interest shown in polar research. The publication of professional papers by members of the staff; the work undertaken in the way of a revision and definitive establishment of standards of pressure and temperature; a promise that after a while something will be attempted in the way of a study of atmospheric electricity; and the proposition to offer prizes for essays upon various meteorological problems, competition to be open to the world, — are all straws that show which way the wind is blowing.

At the same time, the general observation work has been much extended by the wise and hearty interest which the chief signal officer has shown in the establishment of state weather services, which have rapidly increased in number through his encouragement and material aid. This is particularly fortunate just now, when the general service has unfortunately been crippled by the failure on the part of congress to make sufficient appropriations. In short, it is only just to Gen. Hazen, to say that he has greatly enlarged the scope of the service, and that he has materially strengthened it by a broader recognition of the relations which ought to exist between it and the science of the country.

It is difficult, however, to review the past without indulging in speculations concerning the future. It must be admitted, that the work of the meteorological bureau falls far short of the standard which many of its friends have set for it. Many, indeed, believe that it will continue so as long as it remains a military rather than a civil service. Each successive report of the chief signal officer has contained long arguments in defence of its military organization; and, unintentionally no doubt, the same reports have furnished strong arguments against such organization. In order to improve the character of the observing corps, considerable efforts have been made, for two or three years past, to induce well-educated and well-trained men to enlist in the service. Under the present organization, it does not seem that the work could have any great attraction for a college-bred man. In the first place, he must enlist as a private in the army for a period of five years. It is true that the service is special, and that his chance for promotion up to a certain point is fair; but before beginning his work as an observer, he is obliged to go through months of military drill, study, and discipline, the relation of which, to the duties which afterward devolve upon him, it is difficult to see. Proficiency in the 'manual of sabres' or the 'manual of the kit' will not greatly facilitate his making a barometric reduction or a dew-point determination. Even after the service is fairly entered, objections to the military system are not less strong. Permanency of position is very desirable in any occupation, and it goes farther than most other things in securing the best attainable results; but it must be a permanency very different from that which obtains in a military service.

The difference is best seen by a comparison of the relations existing between the service and the two divisions of the staff of the chief signal officer, the civil and the military. The young civilians who have recently become *attachés* of the central office have been led to do so, it is almost certain, by their own fondness and predilection for the study of meteorology. They bring to their work a vigor and enthusiasm resulting from a thorough collegiate training, followed by post-graduate work in which observation and research have played the most important part. The permanency of their positions, and their advancement to more responsible places, will, or at least should, depend solely on the value of their services. With the laudable ambition to establish a reputation among scientific men, they have every incentive to hard work, that success may be achieved, and failure, which would be to them disastrous, avoided.

But by far the greater portion of the work at the central office, and that which is doubtless the most immediately effective, is done by commissioned officers of the army. While it is true that many of them have fairly earned distinction through their conscientious labors in the weather bureau, it cannot be claimed that the relation which they sustain to it, and which is no fault of theirs, is that which would be for the best interests of all concerned. Except the very few who have been promoted from observer sergeants, they have been ordered to the service from other occupations and other branches of the army. As a special training to fit them for the work, they have the year at Fort Meyer, during which the study of meteorology is not allowed to interfere materially with other occupations. They enter the central office at the close of this year, having had an experience of eight days in practical meteorology. When, after further study and practice, they become really useful, they are likely to be transferred to some other post and duty for which this training has in no way fitted them; for the policy of the army seems to be in the direction of frequent changes of location of its officers. But by far the worst feature of the case is that there is no particular incentive to induce them to devote themselves earnestly to the work. If, through interest and industry, one succeeds, he is probably retained in the office longer than he otherwise would be: if, through indifference and neglect, another fails, he is likely to be transferred to some other branch of the general service without loss of rank or reputation. It is also true that the meteorological work of the signal service is looked upon with disfavor by many army officers, as not being a legitimate addition to their duties. Under such conditions, and for many other reasons not necessary to mention, it does not seem possible for the weather service to reach that high degree of efficiency which is believed to be possible under a different organization; and it will require weightier arguments than those annually reprinted in the report of the chief signal officer to prove the contrary.

THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

ROUEN MEETING, AUG. 16-23, 1883.

THIS association has just held its twelfth annual session at Rouen, the ancient capital of Normandy, situated on the Seine, between Paris and Havre. It is, I believe, the youngest association of its kind, but is not, for that reason, the less worthy of study. Perhaps, to an American, its most striking feature is its resemblance, in its organization and proceedings, to its sister across the water. It has its permanent secretary to organize its business and give information to members, its daily programmes, its general meetings, its sectional meetings, and its excursions, all fulfilling the same objects as with us. It has even gone through the same process of evolution, and reached the same stage of development, in becoming a representative of popular and applied, rather than of very 'high,' science. Its members already complain, that, when one is elected a member of the Academy of sciences, he no longer affiliates with the association. I have recognized but two academicians at the meeting, and doubt if there are more. But it must not be inferred from this, that the members and their papers are unimportant: on the contrary, the number of eminent teachers, authors, and investigators, who read papers and take part in the proceedings, is decidedly greater than in the American association. If there are fewer academicians than with us, there are also fewer circle-squarers, essayists, and propounders of school-boy problems. On the list of papers presented, there is not one upon atoms, ether, the nebular hypothesis, or the origin of the present form of the universe.

The range and treatment of subjects are much wider than with us, and one is especially struck with the prominence assumed by social science and engineering. It would seem as if the blind passions, which are so apt to stir the laboring population of France and to lead them toward a policy of general social disintegration, had led the thinking and wealthy classes to give especial attention to the question of the welfare and pacification of the workingman. Not only is political economy one of the most prominent subjects, but discussions of plans for improving the condition of the laboring-class form a leading feature of the proceedings. The plan which seems to have met with most success is that of making the workmen in large establishments sharers in the profits. One speaker described, at length, the working of this plan in a great dyeing-establishment,

where it would seem to have proved a great success, although coupled with conditions which would hardly have been accepted by an American artisan. I do not know what interest our railway-companies take in the personal welfare of their employees; but the examination of what is done by the Western railway of France, as exhibited and explained to the association, is suggestive of a philanthropic as well as of a business institution. Bedrooms, baths, eating-rooms, medical attendance, savings bank, and life-insurance are among the privileges provided by the company, of which each and every employee may avail himself according to circumstances.

The prominence of engineering questions was due to a cause which shows that human nature is much the same through the civilized world. Rouen is engaged in river improvements, of which the object is to make it a great seaport; in fact, to make it to Paris what Liverpool is to London. Great pains were therefore taken to secure the attendance of distinguished engineers from abroad as well as from home; and harbor improvements, especially those of Rouen, formed the most prominent subjects of discussion in the section of engineering. How far the French association is ready to go beyond its fellows in this direction, is further shown by the fact that one of the prominent papers in the engineering section was devoted to the exposition of a scheme for a metropolitan railway in Paris, similar in its object to those of London and New York, which could be built at a cost of two hundred million francs. No one hinted that the subject was not germane to the objects of the society.

There is at least one custom of the meeting worthy of imitation by the American association; namely, evening lectures by members, on subjects of general scientific interest. These lectures are not gotten up at hap-hazard on the spot, but are arranged by the secretaries, long enough in advance of the meeting to admit of careful preparation. Those of the Rouen meeting were: The transit of Venus, by Mr. Hatt, chief of one of the French expeditions; and on the Transmission of energy, by Professor Comberousse. The general character of these lectures was the same so familiar to us at home; but it was noteworthy, that French science was almost exclusively considered. Occasional references to the works of other nationalities were rather to show that the speaker knew something about them, than to give full information respecting them.

In two points the French association makes a decidedly more favorable showing than our own. One has already been mentioned, — the absence of the respectable gentleman who writes interminable essays on scientific subjects of which he knows nothing except from current literature. In the mathematical section, the papers read were of decidedly greater importance than those to which the American association is accustomed. The other is the financial condition of the society. In few respects does American science show to greater disadvantage, beside that of Europe, than in its power of raising money to promote its objects. The income of the French association for the current year was reported at 85,000 francs. It has already an invested capital of about 450,000 francs. It expended 39,000 francs in printing its proceedings, 20,000 in administrative expenses, and 14,000 in grants for researches of various kinds.

Let us compare this sum total with the income of the American association.

Income of French association	$16,600
" American "	8,943
Difference in favor of France	$7,657

And we must remember that this is not a case in which the excess is due to greater age; for the French society is only one-fourth the age of the American. The comparison will afford us food for profitable reflection.

EVIDENCE FROM SOUTHERN NEW ENGLAND AGAINST THE ICEBERG THEORY OF THE DRIFT.[1]

In presenting to the association evidence from southern New England with regard to the insufficiency of the iceberg theory of the drift, I shall have to say some things that have often been said before, and by various investigators. But I may claim for what is here brought forward, that it is, in my own mind, the fortified conclusion of long-continued investigation.

The arguments on the subject are derived from three sources, —

I. The scratches and groovings over the rocks.

II. The transported bowlders and other material.

III. The facts as to the relative level of the land and sea.

I. The scratches or grooves over the rocks.

Under this head there is, first, the old argument based on the universal distribution of the scratches over the region of all New England. These effects of abrasion are to be

[1] Read at the Minneapolis meeting of the American association for the advancement of science.

found everywhere beneath the soil, each fresh exposure of the rocks bringing them to light. This was said years ago; and the conviction of its truth has been gaining force with every year of additional observation.

a. In view of this fact, it is urged rightly that only an abrading agent that pressed heavily against the broad rocky surface could have produced the effects; and such is not an occasionally grounding iceberg, or a succession of them. Neither is it the still more locally acting shore-ice.

b. Floating ice would have found little bare rock over the sea-bottom to be abraded. Like the bottom of existing seas, and eminently those of the continental borders, the submerged region would have had for the most part a bottom of detritus, its former detritus, and additional detritus from later depositions. The removals would have been local, and relatively of small area. Consequently, the drifting ice would rarely have reached down to the rocks. Shore-ice carried along by the currents would have had a better chance, and yet a poor one, for the work to be done.

c. The character of the groovings and ploughings is, to a great extent, such as floating ice could not have produced. As has been often said, the close uniformity of direction and parallelism over large areas, which so generally prevails, is not a possible result of iceberg action. The needed pressure and steadiness of movement are wanting. Troughs in hard granite even six inches deep are the work of one and the same moving tool for a long period; and one year would be long for the steady action of an iceberg. If grounded, it would do almost nothing; if floating free, absolutely nothing; and a nice adjustment to depth would be required for any steady abrasion, much nicer than would have long continued anywhere over the uneven bottom.

In the triassic sandstone of East Haven, Conn. (just east of New Haven), at a place where the sandstone is a very firm, thick-bedded, gritty rock, the ploughing ice ploughed out a piece of moulding, somewhat like the *ogee* of the carpenter, which was 8 feet deep, 25 feet wide, and over 150 feet long, and perfectly even in surface as well as direction.

d. The currents that would have borne along the icebergs over submerged New England, in case of a submergence sufficient to cover the highest striated surfaces, — 3,000 to 5,500 feet, — would have been those of the present ocean, the Labrador current, and Gulf stream; and, with less submergence, the same in part, modified by the courses of the valleys and the tides.

It is to be noted, that the New-Haven region, in Connecticut, is the southern extremity of the Connecticut valley. The mean trend of this valley in Connecticut is about S. 15° W., and, in southern Connecticut, S. 18° W. Now, the numerous scratches over the *eastern* portion of the New-Haven region average in direction S. 16° W.; but along its *western* border, where the rapidly rising slopes give the region rather an abrupt limit 150 to 350 feet high, the scratches have an average course of S. 33° W., the extreme being S. 27° W., and S. 55° W.; and S. 33° W. is the almost uniform trend over the undulating surface of the country for six to nine miles west. It is, as far as I can see, impossible that the valley stream should have had on its west side so wide a divergence from the direction of the Connecticut valley: all the features of the region oppose it. The scratches are well exposed over the metamorphic rocks in many places; and large and perfect examples of *roches moutonnées* here occur.

Again: over the higher lands of western Connecticut (and of New England generally, according to the observations of Prof. Edward Hitchcock, Prof. C. H. Hitchcock, and others), the direction of the scratches is south-eastward. To have produced them, if icebergs were the agent, the submergence should have exceeded 2,500 feet, and this would have given a chance for the full play of the oceanic currents; and yet the above direction does not correspond with that of either of the great currents.

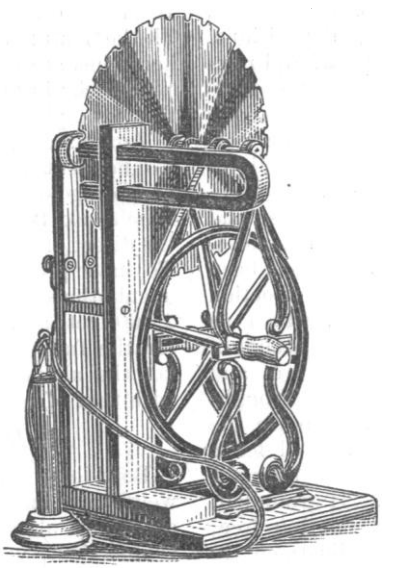
II. Distribution of the drift.

Bowlders of trap, from 50 to 1,000 tons in weight, are numerous in the New-Haven region, especially along its western border. All are Connecticut-valley travellers; for the trap ridges of the valley — 400 to 1,300 feet in height — are the only possible source. They were gathered up by the ice from these trap ridges, and were carried 15 to 60 miles down the valley. It is mechanically impossible that the larger bowlders should have been taken up, or gathered in any way, by floating ice; either shore-ice, where the water was but 1,000 feet deep and less, or by that of icebergs, where the depth was greater.

It is well known, that the distance of drift transportation is in general less than 20 miles. Hills of but 100 feet often have their long trails. A moving glacier would easily gather and carry along the material from hills, high or low, wherever loose or detachable masses of rock or gravel existed to be gathered; while floating ice would be very poor at gathering, and hence inefficient in distributing.

III. Relative level of the land and sea.

I have examined carefully along southern New England for proofs of the quaternary submergence which the iceberg theory assumes to have existed in the glacial era. I thought at one time that I saw evidence about New Haven of a submergence of 45 to 50 feet. But the terrace that afforded the evidence was situated six miles back from Long Island Sound, adjoining the rivers; and on further examination I found that the deposits had precisely the structure of those along the river-valleys farther north, and that, in fact, they were nothing but fluvial formations. The highest terraces on or near the shores of the sound, in the vicinity of New Haven, have a height above mean tide of 23 to 26 feet; and on Milford bay, nine miles west, a similarly situated terrace has a height of 30 to 33 feet. Along the hills facing the waters, and the southern extremity of the valleys, no traces of any higher level exist. Twenty-five to thirty-five feet is the greatest amount of submergence the facts sustain. Sea-border deposits exist at a higher level on the coast of Maine and on the shores of the St. Lawrence, and show what was the position of the shore-line in those regions. But the level along southern New England is not proved by the facts there gathered, neither is it established by the demands of the iceberg theory.



In conclusion, if icebergs, or floating masses of ice, were not capable of covering with scratches great continuous areas, and would have had a chance for little rock-abrasion on account of the covering of detritus; if they could not have made, in their hitching and swinging way of action, when touching bottom, scratches over great areas, that had the even course and parallelism characterizing those of drift regions, or could not have ploughed out the deep furrows; if they could not have gathered the great bowlders for transportation; and if the sea along the sound did not cover the land, in any part of the era of ice, to a greater depth than 30 or 35 feet, — the iceberg theory of the drift may be reasonably pronounced unsatisfactory for southern New England; and similar facts show that it is equally unsatisfactory for the rest of New England.

James D. Dana.

THE MAGNETOPHONE.[1]

The experiments of Bell,[2] Preece,[3] Mercadier,[4] and others on the radiophone, suggested to me the possibility of interrupting, or at least periodically modifying, the lines of force proceeding from the poles of a magnet, by means of a disc of sheet iron, perforated with a series of equidistant holes, and rotated so that the holes should pass directly in front of the magnetic pole. It is well known that an armature, placed on the poles of a permanent magnet, diminishes the strength of the external field of force by furnishing superior facilities for the formation of polarized chains of particles from pole to pole. This is the case even when the armature does not touch the poles, but is in close proximity to them.

If a piece of sheet iron be placed over the poles of a magnet without touching, and the magnetic curves be developed on paper above the iron, they will be found to exhibit less intense and less sharply defined magnetic action than when the sheet iron is removed. If, however, a small hole be drilled directly over each magnetic pole, the screening action of the sheet iron is modified in much the same way as when a hole is made in a screen opaque to light; for the developed curves show distinctly the outline of the holes. If, therefore, the sheet iron in the form of a circular plate, pierced with a number of holes, be rapidly rotated between the pole of a magnet and a small induction bobbin, the action of the magnet on the core of the bobbin will be periodically modified because of the passing holes; and hence induced currents will flow through a circuit including the bobbin. A disc of sheet iron was pierced with two circles of quarter-

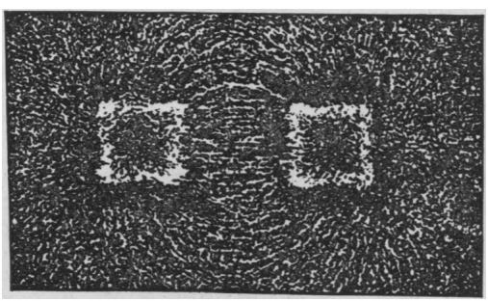
[1] Read at the Minneapolis meeting of the American association for the advancement of science.

[2] Proceedings Amer. assoc. adv. sci., xxix. 115. Smithsonian misc. col., xxv. 143.

[3] Proceedings Royal society, xxxi. 506.

[4] Journ. phys. x. 53.

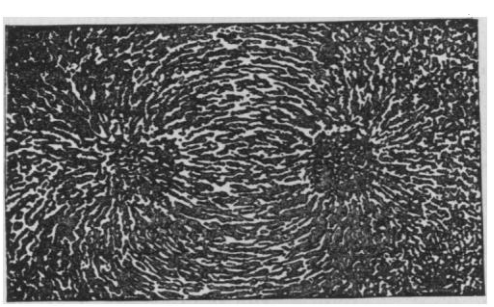
inch holes concentric with the disk, the number of holes in the two circles being thirty-two and sixty-four respectively. On one side of the disk was placed a horse-shoe magnet with its poles very near the rows of holes; on the other side were arranged two corresponding induction bobbins. The circuit was completed through a telephone and either bobbin at pleasure. Upon rotating the disk rapidly, a clear musical sound was produced in the telephone, the pitch rising with the rapidity of rotation. Moreover the bobbin opposite the circle of sixty-four holes gave the octave above the other, and each gave a note of the same pitch as was produced by blowing a stream of air through the corresponding holes. Hence, as a beam of light, focused upon a circle of equi-distant holes in an opaque disk, is rendered periodically intermittent by the rotation of the disk, and produces a musical tone when falling upon the proper receiving-apparatus; so the lines of force proceeding from a magnet may be rendered periodically intermittent in their action on an induction bobbin by a similar metallic disk, set in rapid rotation; and the induced currents, arising from the periodic change of magnetism in the core of the bobbin, produce a musical tone in a telephone, the pitch depending in both cases only upon the number of holes passing in unit time.



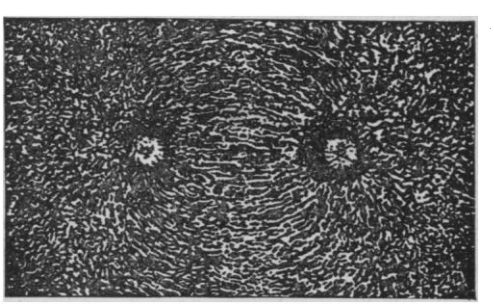
MAGNETIC CURVES OVER HORSE-SHOE MAGNET.

The experiment was modified by so placing the poles of the magnet that the same circle of holes passed them in succession. By the proper connections, the currents from the two bobbins were made to pass either in the same or in opposite directions through the telephone. In the latter case, an almost perfect neutralization of currents took place, so that the sound was scarcely audible.

Non-magnetic metallic disks produce similar musical notes by the periodic modification of the magnetic field by means of the distortion or bending of the lines of force. The solid parts of the conducting disk deflect the lines of force in the direction of the rotation; but upon the passage of a hole, they fall back toward their normal position. A periodic movement of the lines of force will, therefore, take place when the disk rotates. Disks of zinc and copper produce a clear musical sound, somewhat less intense than that given by iron under the same conditions. Any discontinuity in the rotating disk recurring periodically will produce corresponding induction currents in the bobbins. Thus, V-shaped notches round the circumference of the disk are quite as efficient as the holes in effecting the requisite modification of the magnetic field. Moreover, it is not necessary that the holes extend entirely through the disk. Two disks of zinc, of the same diameter and thickness, were placed together on the same rotating spindle, one pierced with a circle of holes, and the other not. The combination proved as efficient in producing the sound as the single perforated disk.



EFFECT OF SCREEN OF SHEET IRON.



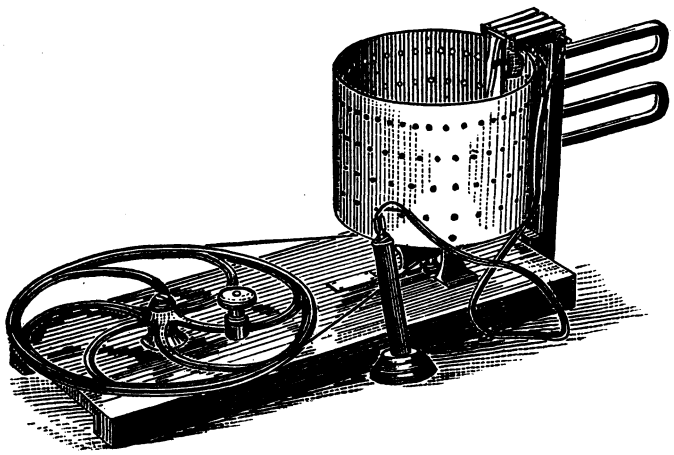
EFFECT OF HOLES THROUGH THE IRON SCREEN.

A sheet of tinfoil, with a circle of small holes, was pasted on the continuous zinc disk. The perforations, extending only the thickness of the tinfoil into the compound disk, constituted a sufficient discontinuity to produce a clear,

though somewhat faint, musical sound. About the same result was given by a disk consisting of the same sheet of tinfoil pasted on cardboard.

Any periodic variation from uniformity in the disk appears to produce corresponding variations in the magnetic field when the disk is rotated. Depressions made with a punch, at regular intervals, in a zinc disk, rendered it a sound-generator when rotated in this apparatus.

Since the pitch of the note obtained depends only on the number of holes passing the pole of the magnet in a second, it is easy to construct a piece of apparatus to illustrate musical intervals. A cylinder of galvanized iron, with four rows of holes in the ratio of 4 : 5 : 6 : 8, was



mounted on a whirling table, and provided with two U-magnets and two electro-magnets for induction. The latter were placed inside the cylinder, and the former outside. By means of four keys, any one of the bobbins, or all of them, can be put in circuit with the telephone. By depressing the keys, the four notes of the common, or major, chord are brought out with great distinctness and clearness. In fact, the intensity of the sounds obtained by the magnetophone is sometimes so great as to be painful to the ear when the telephone is held closely against it.

The above experiment was simplified by employing a disk perforated in four concentric circles with 24, 30, 36, and 48 holes respectively. A telephone with the mouthpiece and diaphragm removed, was presented to the four rows of holes in succession, with the production of the four notes of the major chord as before, clearly defined, but not so loud as with the other apparatus. Further experiments are in progress.

H. S. CARHART.
Evanston, Ill.

THE WEATHER IN JULY, 1883.

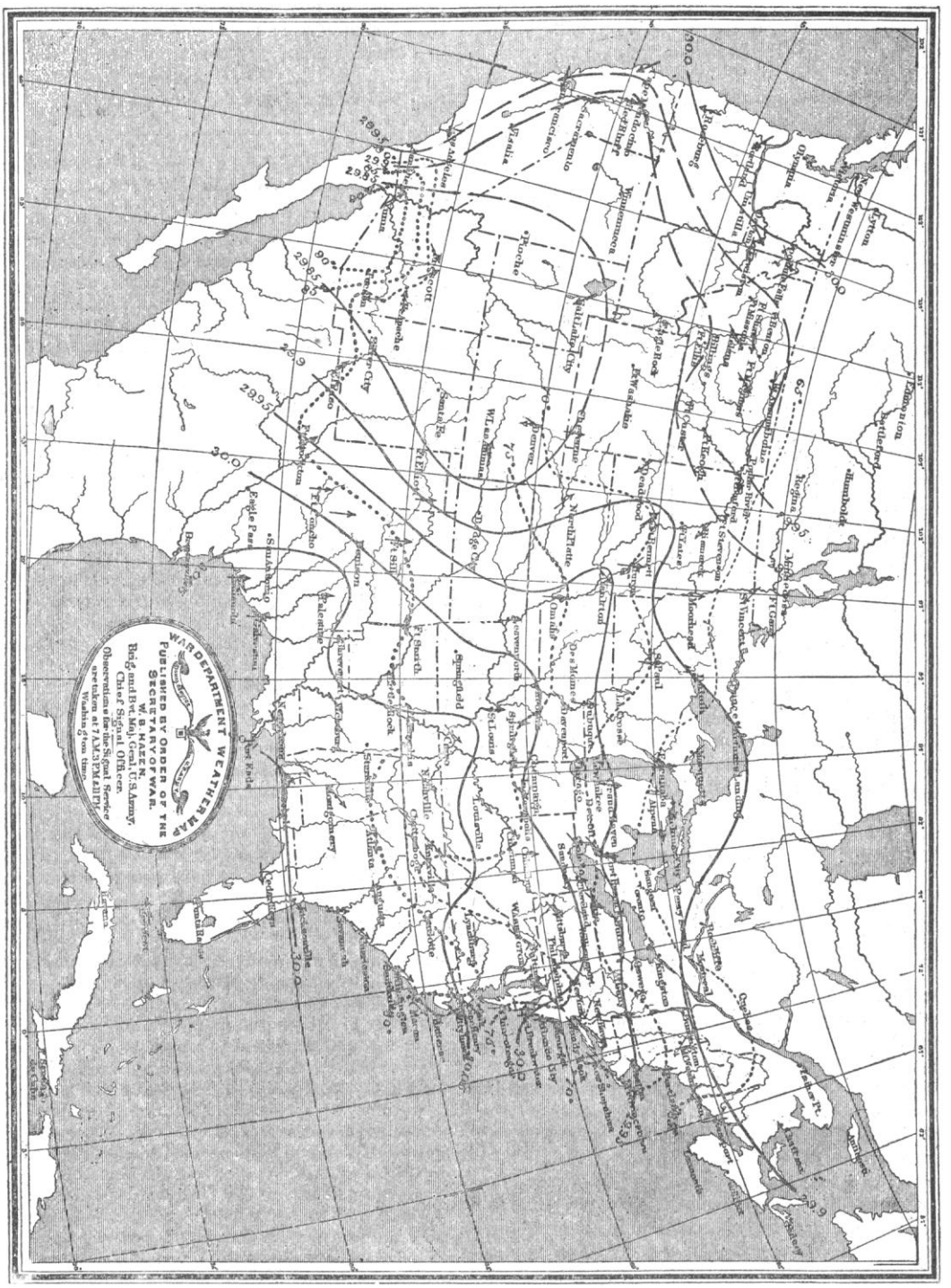
THE monthly weather review of the U.S. signal service shows that the most noteworthy characteristics of July were the large deficiencies in rainfall in the southern states and in the north-west, the low mean temperature in nearly the whole country, and the severe local storms, which were frequently accompanied by lightning and hail.

The pressure was nearly normal, the departures in few instances exceeding .05 inch. The progress of eight depressions has been charted. Only one of these passed south of New England, and none visited the southern states. None were traced from the Pacific coast, and four apparently developed in the Rocky-mountain region. One only of these depressions is deserving of the name of a severe storm. This developed in Colorado on the 4th, and reached Nova Scotia on the 7th, accompanied by heavy rains in the lake region, and violent local winds at Hatteras and Sandy Hook. The storm proceeded across the Atlantic, and on the 11th was central off the north-western coast of Ireland, causing heavy squalls and high seas during its passage.

The chart of ocean-ice shows, that, since the preceding month, the eastern limit has moved about 2° westward, and the southern limit about 2° northward. There is a marked diminution in the number of icebergs observed, compared with July, 1882.

The temperature has been below the average, except in the Pacific districts, the northern plateau region, the south Atlantic and east gulf states; but the departures have been small. In New England, the middle Atlantic and west gulf states, the temperature was less than 1° below the normal, while the greatest difference was 3° below in the extreme north-west. A maximum of 112° was recorded at Phœnix, Arizona; and frosts occurred in northern New York, Michigan, Wisconsin, Iowa, New Hampshire, and Pennsylvania.

The special feature in the precipitation record



MONTHLY MEAN ISOBARS, ISOTHERMS, AND WIND-DIRECTIONS, AUGUST, 1883. REPRINTED IN REDUCED FORM BY PERMISSION OF CHIEF SIGNAL-OFFICER.

is the large excess in the upper lake region, New England, and the upper Mississippi valley; and the large deficiency in the southern states, which materially affected the crops in that section. The following table contains the rainfall record: —

Average precipitation for July, 1883.

Districts.	Average for July. Signal-service observations.		Comparison of July, 1883, with the average for several years.
	For several years.	For 1883.	
	Inches.	Inches.	Inches.
New England	3.92	5.76	1.84 excess.
Middle Atlantic states	4.04	3.28	0.76 deficiency.
South Atlantic states	5.65	4.92	0.73 deficiency.
Florida peninsula	5.77	4.49	1.28 deficiency.
East gulf	5.04	2.50	2.54 deficiency.
West gulf	4.16	2.44	1.72 deficiency.
Tennessee	4.06	3.07	0.99 deficiency.
Ohio valley	4.55	5.35	0.80 excess.
Lower lakes	3.84	4.51	0.67 excess.
Upper lakes	3.36	5.42	2.06 excess.
Extreme north-west	2.83	2.44	0.39 deficiency.
Upper Mississippi valley	4.02	5.58	1.56 excess.
Missouri valley	4.44	3 37	1.07 deficiency.
Northern slope	1.94	0.82	1.12 deficiency.
Middle slope	2.77	2.57	0.20 deficiency.
Southern slope	2.50	3.19	0.69 excess.
Northern plateau	1.01	0.00	1.01 deficiency.
Southern plateau	2.35	2.50	0.15 excess.
North Pacific coast	0.58	0.00	0.58 deficiency.
Middle Pacific coast	0.01	0.00	0.01 deficiency.
South Pacific coast	0.08	0.15	0.07 excess.

In some portions of the southern states, the deficiencies were even greater than those recorded in the above table: at New Orleans the rainfall was 5 inches less, and at Vicksburg 6.82 inches less, than in July, 1882. Eastport, Me., reports a fall of 5.24 inches in 10 hours, on the 14th inst.

The local storms reported are very numerous, and much damage resulted from rain, lightning, and hail. The greatest damage from rain was at London, Ont., on the 10th, due to the overflowing of the river Thames. Much damage to crops, especially in the west, was caused by hail. A vessel in lake Michigan reports a hail-stone weighing two pounds. The rivers were not high, except at the very beginning of the month; and navigation was suspended in the Savannah and Cumberland rivers on account of low water.

Among miscellaneous phenomena may be noted the brilliant aurora on the nights of the 29th and 30th, which was observed from Dakota eastward to New England, and southward to southern Virginia. Slight earthquake shocks were experienced in Nevada, Illinois, California, and Kentucky; though insignificant in comparison with that on the island of Ischia, of which a condensed account is given. Sun-spots were numerous; and an instance is noted in Oregon, of their observation with the naked eye, taking advantage of the smoky state of the atmosphere caused by forest-fires.

The accompanying chart represents the distribution of the mean pressure, temperature, and wind direction for the month.

THE EARTHQUAKE OF JULY 28, 1883, IN THE ISLAND OF ISCHIA.[1]

HAVING visited the island of Ischia by order of the inspector-in-chief of the Royal corps of mining engineers, a few days after the earthquake of the 28th July, I present some observations made during my short tour; and begin with a brief account of the topographical and geological conditions of the island, which last are, without doubt, the chief cause of the terrible disaster.

The formation of the island of Ischia is wholly volcanic, with the exception here and there of some argillaceous elevations, of marine formation, but derived from the disintegration of pre-existing volcanic matter. In connection with the islands of Vivara and Procida, it belongs to the volcanic group of the Campi Flegrei, and forms its western limit.

The aspect of the island as seen from the north is pleasant and delightful, although with deep hollows crowned by the towering and indented crest of Epomeo, rising to an elevation of 792 metres.

The town of Casamicciola, now destroyed by the terrible scourge, was built on the side of Epomeo sloping towards the north, upon two small hills, beside which flow two of the principal streams of the island, one near the mountain, fed chiefly by the waters of thermal springs, the other emptying into the sea near Lacco Ameno, a little farther to the west; these run from south to north; and another more important stream, called the Scarrupato, runs from north to south, flowing through a deep and precipitous valley on the southern slope of the island, having on its banks the villages of Fontana, Serrara, Moropane, and Barano. These last two streams are, in my opinion, very important; being, as we shall see, situated directly in one of the principal gorges of the island.

Forio is on the west coast, upon a plain gently rising towards Epomeo, bordered upon the north by Mount Zale. Eastward of Casamicciola are seen the volcanoes of Monte Rotaro and Montagnone (respectively 215 and 236 metres in height.)

According to Fuchs, the most ancient terrane of the island is composed of the tufa of Epomeo, of a clear green color, containing numerous sanidin, and sometimes pumice and lapilli. On this rest, here and there, strata of pumice and trachytic tufa, and depositions of trachytic lava, with beautiful sanidin from the mountains Rotaro, Montagnone, Tabor, Garofali, etc., which may also be seen on the road from Lacco Ameno to Forio, forming the promontory of Zale.

On the tufa of Epomeo rests a great extension of

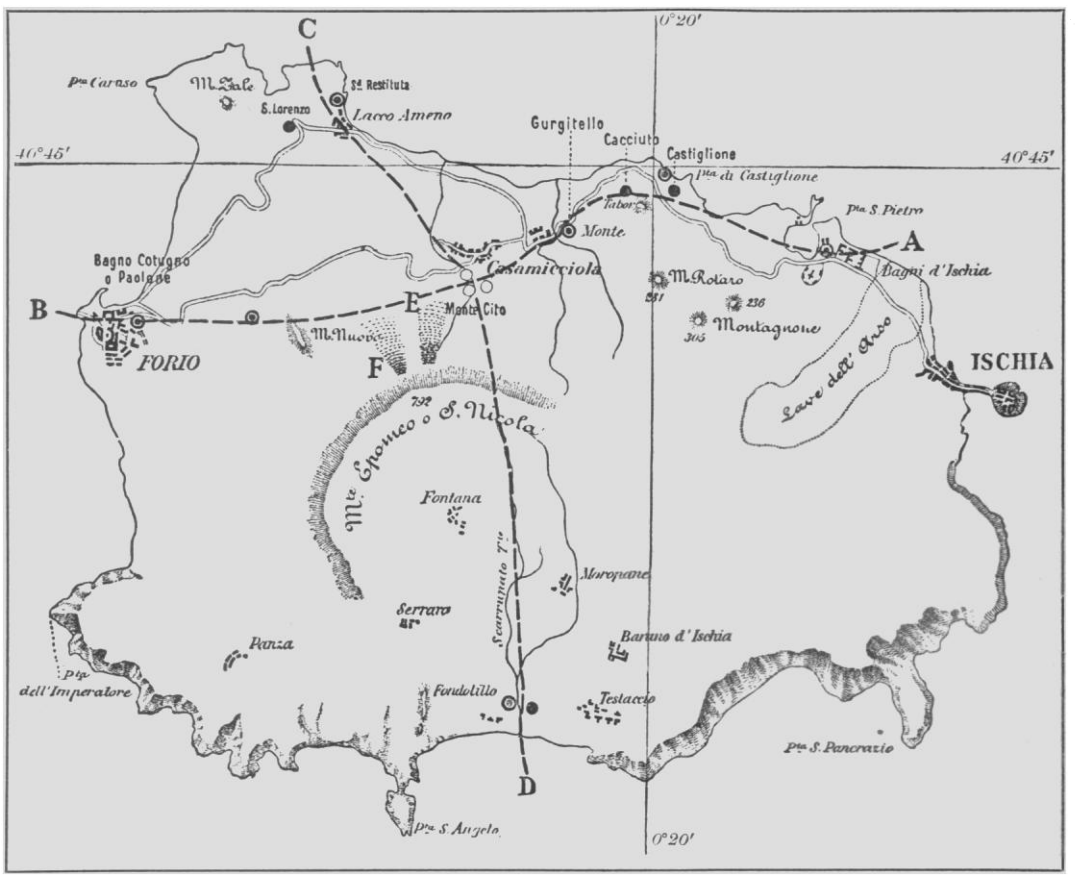
[1] Translated from the Italian of L. Baldacci of the Royal corps of mining engineers (*Boll. R. com. geol.* 1883, nos. 7, 8).

a product of decomposition of this tufa, of submarine origin, which passes occasionally into a plastic argillite well suited for the making of brick. Casamicciola was built upon this disintegrated clayey soil; while Lacco is partly upon trachyte, and partly upon the tufa of Epomeo; and Forio, as also Fontana, Serrara, etc., are built exclusively upon the above-mentioned tufa.

To these formations constituting the island must be added the trachytic lava and scoriae of Arso, the last eruption of which occurred in the year 1301; and, finally, the gravelly or clayey deposits, containing numerous marine fossils of species now living, indicating, that, in an epoch not very remote, a great part of the island was submerged.

For the description and analyses of the rocks forming the soil of Ischia, we must refer to the very important monograph of Fuchs previously cited: what chiefly interests us now is to observe how they are connected with the manifestations of innate activity which are developed in the island. These are of three classes, — hot mineral springs, stufas or jets of aqueous vapor, and fumaroles. These will be easily seen on the accompanying chart. They could not all be given with so small a scale, but I was obliged to limit myself to the most important.

The northern coast contains the chief evidences of volcanic activity. Thus, traversing the coast from east to west, we find the thermal springs of Pontano, Fornello, and Fontana, near Ischia; the stufas and thermal springs of Castiglione, near the point of that name; the stufas of Cacciuto, on the trachytic lava of Tabor; the rich and abundant thermal springs of Gurgitello, near the mountain (il Monte) at Casamicciola, besides others, less important, in that neighborhood; the fumaroles of Monte Cito, to the west of Casamicciola, which on the day of my visit was actively emitting steam and sulphuric acid from different crevices in the tufa of Epomeo; and, finally, trending slightly to the south-west, the thermal springs which are so valuable at the Bagno Cotugno or Paolone of Forio, and which flow from the side of Monte Nuovo



ISLAND OF ISCHIA, EARTHQUAKE OF JULY 28, 1883.

⊙ Hot mineral springs. ● Stufas and jets of steam. ○ Fumaroles. AB, CD, supposed fissures. E, F, Land-slides, happened since July 28.

at the east of that town. In these jets of water, steam, and gas, the temperature always ranges from 40° to 100° C.

From these elements, it appears to me, we may reasonably conclude that there exists a large curving line of cleavage from which arise such manifestations, turning its convexity chiefly to the north, running between the baths of Ischia and Forio, and passing exactly through Casamicciola (A B on the chart).

Examining now the other principal manifestations from north to south, we find in Monte Zale and Marecocco, near Lacco Ameno, the thermal springs of Santa Restituta and the stufas of San Lorenzo, the fumaroles of Monte Cito, already mentioned, in the stream which flows into the sea near Lacco; and in the same direction, on the other slope of Epomeo, we have the valley of the Scarrupato, at the southern end of which we find the hot springs of Fondolillo and the stufas of Testaccio. I am assured that on this line will be found other similar but much less important fumaroles, also on the heights of Monte Epomeo; but for want of a guide or exact indications, I cannot verify the assertion. Therefore, also, there is evident to me the existence of another fracture running from north-north-west to south-south-east, which crosses the first exactly at Monte Cito, almost under the town of Casamicciola (C D). These two grand lines of fracture are designated by broken lines drawn upon the annexed chart.

The reason which inclines me to believe that there are two principal fractures, and not an intersection of the fracture C D with the line of superposition of one crater (that of Epomeo) upon another, submarine and more ancient, according to the opinion of the celebrated Prof. de Rossi, is the identity of the manifestations along the two lines, A B and C D; the thermal springs, the stupas, and the fumaroles being identical in the two cases, I believe that they may be more simply attributed to an identical cause, without having recourse to hypotheses hitherto not entirely demonstrable by facts.

As to the phenomena which heralded the terrible disaster, the information collected on the spot is somewhat contradictory. It is certain only, that, for some days previous, slight shocks were felt with faint rumblings; that the springs of Gurgitello, etc., had shown irregularities of quantity and temperature; and that the fumaroles of Monte Cito, hitherto almost inactive, had evinced symptoms of excitement, emitting a peculiar hissing and quick jets of steam and sulphurous acid. It is said that the wells of Casamicciola and Forio were almost dried up, but that assertion does not agree with the facts. There are no spring wells in Casamiccola and Forio, only cisterns; and a scarcity of water observed in some, not all, of these, might perhaps be attributed rather to the drought prevailing for some time in Ischia, than to cracks in the walls of the cisterns. At Forio, I learned from trustworthy persons, that, in the cisterns between San Pietro and the upper part of the town, a remarkable increase of temperature was observed in the water. That seems highly probable, such cisterns being exactly in the direction and neighborhood of the great fracture above described.

The shock which brought desolation upon these lovely regions occurred on the evening of 28th July, at 9.25 P.M. I need not dilate upon its deadly effects, which are already too familiar from numerous accounts. The shock was accompanied by a horrible bellowing, and lasted, apparently, twenty seconds. Casamicciola, Lacco Ameno, and Forio were almost levelled to the ground, with a frightful sacrifice of life; Serrara, Fontana, and other lesser villages suffered terrible injury. The seismic disturbance was felt at Ischia, — where, however, it did but little damage, — and extended to great distances, having been indicated by the seismographs at the geodynamic observatory of Rome.

At Casamicciola and Lacco Ameno, the shock was vertical at first, and then undulatory. Information obtained at the place, and the few observations which I was able to make, indicate that the direction of the wave at Casamicciola was from west to east, then from north to south; at Lacco Ameno, from south-east to north-west; at Forio, the shock was first vertical, then undulatory, and the direction from north-east to south-west. In examining the localities destroyed, I could observe but little in respect to the greater or less resistance offered to the shock by buildings according to their orientation: this idea was advanced by Prof. de Rossi in his account of the earthquake at Casamicciola, in March, 1881, and is certainly based on sound reasoning and also on proved facts. But, in the first place, this shock was so violent and complete that but few walls had been left standing; and secondly, at the time of my visit to Casamicciola, eight days after the catastrophe, the state of the ruins was no longer such as was caused by the earthquake alone: many walls had been torn or thrown down, in order to render less difficult and dangerous the work of rescuing the living, exhuming the dead bodies, and searching among the ruins.

Among other things, I could perceive that some of the walls still standing presented crevices at an angle inclined 30° or 40° from the vertical, with the apex upward, indicating a prevailing upward and downward movement.

On the upper portion of the front wall of the church of the Anime del Purgatorio, in Forio, I observed a clean horizontal crack, showing here, also, the decidedly vertical character of the shock. This character seems confirmed by the condition of a large gate at a short distance to the east of Forio: only the two blocks of stone forming the lower part of the jambs remain in place; the two blocks upon them are thrown towards each other, projecting about six centimetres from those beneath, while the upper parts and the arch have fallen down.

Between Forio and Casamicciola, it seems as if the greatest seismic activity had been manifested along the road joining the two towns, passing by S. M. delle Grazie, and under Fango. The road is, in fact, completely destroyed, and the little cottages that bordered it are ruined. Besides this, the shock has produced two great land-slides, which, descending

from the precipitous flanks of Epomeo, have covered a wide extent of chestnut-groves and vineyards; and on the southern slope are great fissures in the earth.

In summing up my observations of all the localities most devastated by the calamity, I am convinced that the buildings standing upon the trachyte at Lacco Ameno and Monte Zale suffered incalculably less than those built upon the tufa of Epomeo and the argillite resulting from its disintegration. Casamicciola was almost entirely built upon this argillite; and it can be said without exaggeration, that not one stone rests upon another. Forio was built upon tufa; and of this town, also, very little remains standing. At Lacco, the houses and walls erected on the trachyte offered, as was stated above, great resistance to the shock, while those built upon the tufa were destroyed.

This agrees completely with the theory of Mallet. Mallet says, that when a seismic or a terrestrial wave passes rapidly from a soil possessing limited elasticity, — as would be the case with our tufas and clays, — to another soil of great elasticity, like the trachytic lavas, it changes not only its velocity, but in some degree also its direction; one part being reflected, the other refracted. The seismic wave, being thus checked, produces a shock in the opposite direction, causing great injury to buildings by the recoil. At the same time the shocks are diminished in force when they reach the more elastic soil, such as granite or trachyte.

This would explain very satisfactorily why Ischia, separated from the cleft AB by the great masses of trachytic lava of Rotaro, Montagnone, and Arso, which would absorb much of the energy of the seismic wave, felt it in so slight a degree.

With respect to the causes of these seismic disturbances, which still continued after the great earthquake of the 28th July, other shocks, accompanied by subterranean rumbling, being felt even when I was on the island and afterwards, it seems to me that they must be attributed to an awakening of the residual volcanic activity of Epomeo. The opinion has been advanced by the illustrious Professor Palmieri, that the violence of the shocks might be especially attributed to the fact of the existence of great subterranean caverns directly beneath Casamicciola, and to the giving-way of the supports which upheld these vaults, caused by seismic action, and facilitated by the weakening of these supports by the underground flow of thermal waters. This opinion does not appear to me to be fully demonstrable. There exist, it is true, in the neighborhood of Casamicciola, caverns of plastic argillite, formed by the lapse of ages; but certainly it is not of these that the illustrious professor of Naples intends to speak: the cause would assuredly be insufficient to produce effects so imposing, and such far-reaching seismic disturbances. I could not enter these caves, for want of persons disposed to serve as guides at such a time; but it is certain that they could be only more or less tortuous galleries of small diameter and but a few metres in height, as is generally the case in such formations. I have been assured also, by persons worthy of trust, and experienced in these caverns, that this is the case. Besides, neither at Casamicciola nor in the vicinity could I see any lowering whatever of the level of the soil: the roads which lead from Guardiola or the shore to Casamicciola, from Casamicciola to Lacco, from Lacco to Forio, have preserved their level perfectly, and show only the longitudinal or transverse fissures inevitable after such a telluric commotion. The only road completely destroyed (but not depressed) is that which leads from Forio to Casamicciola, along the side of Monte Epomeo, which, as we have seen, is directly along the cleft A B.

In any event, when this period of desolation and ruin has passed, when perhaps the time shall have come to decide upon the fittest place to rebuild the shattered dwellings, it would be useful to make a most accurate inspection of all the ancient and modern caverns of the island, and to determine what influence they may have upon the stability of the soil and the superincumbent buildings.

In conclusion, then, it appears to me, 1°. that no other cause need be sought for the shocks which have desolated the island than the volcanic activity which still remains, and awakes at intervals; 2°. that the residual volcanic activity of the island is manifested along two principal fissures, one, A B, a curve with its convexity to the north, from the baths of Ischia to Forio, the other, C D, directed approximately north-north-west and south-south-east, between Lacco Ameno and the stufas of Testaccio; 3°. that the place where Casamicciola stood is upon the intersection of these two lines, and, therefore, at the very focus of seismic activity, and that it has been, and always will be, the locality most liable to be devastated by earthquakes; 4°, finally, that buildings erected upon trachytic lava offer a resistance to the shocks, far superior to that of buildings erected upon tufa or clay, and that this circumstance should be borne in mind when it is proposed to restore the ruined villages.

Rome, Aug. 9, 1883.

JULY REPORTS OF STATE WEATHER SERVICES.

A NUMBER of states have organized weather services which are of material benefit to the people. A brief summary of the July reports that have been received is here given.

Georgia. — The July crop report contains meteorological data from fifteen stations. The special feature is the drought, of which it is said, "In northern and middle Georgia, the drought has been almost continuous since April 23, — the date of the last general rain in the state, — broken only by light and ineffective showers at considerable intervals. A few points reported sufficient rain, but the northern half of the state, with these exceptions, has suffered a most prolonged drought, which is yet unrelieved."

Illinois. — Minimum temperatures of 47° were reported, and maximum of 99°. The prevailing wind

direction was south-west to south; the highest wind velocity was eight miles per hour.

Indiana. — The special feature of this report is the minimum temperature of 50°; the highest temperature noted was 96°, and the rainfall varied from 2.83 to 7.72 inches.

Iowa. — In this state the weather "was very favorable to the crops, being fair, nearly normal in temperature, with an excess of rainfall, and southerly winds prevailing." The greatest rainfall was that of nearly ten inches in north-eastern Iowa, from the 20th to the 23d inst. A number of severe squalls and local storms were reported, which did much damage. Insolation has been high, because cloudy days were rare; the sun thermometer exceeded 140° on twenty-one days.

Kansas. — The report includes one station only, — Topeka; and the month is reckoned from June 20 to July 20. On fifteen days the temperature exceeded 90°, the maximum being 98°. "On June 23, just after a heavy rainstorm, the air having had a temperature of 65° to 70° all the forenoon, the temperature suddenly rose more than 20°, in consequence of a hot current of air from the south. This lasted but half an hour, when the temperature fell as suddenly as it had risen."

Missouri. — The temperature has been considerably below the normal; there being but five instances since 1837, when lower average temperatures in July have been recorded. A minimum of 52° was observed. On the 13th a destructive wind-storm passed through the north-western and northern portions of the state. A railway train, near Browning, was blown from the track, and many towns suffered much damage. This storm was not a tornado, but 'a steady straight blow for upwards of half an hour.'

New Jersey. — The maximum temperatures range from 91° to 98°, the minimum from 52° to 61°, the rainfall from 2.21 to 4.38 inches.

Ohio. — The mean height of the barometer, 30.025 inches, was higher than that of either of the three months preceding. A minimum temperature of 43° was reported. The rainfall ranged from 1.55 at Lebanon to 7.23 at Quaker City, and was above the July normal. "The railway weather signals were continued during July, and by examination of the reports it is found that eighty-six per cent of the predictions were verified." The predictions are those of the U. S. signal office.

Tennessee. — The temperature ranged from 56° to 98°. A range of 0° was reported from Smithville on the 7th. The rainfall ranged from 1.20 to 7.99 inches. Rain fell on the average on nine and two-thirds days, but the rainfall was rather unevenly distributed. "In some localities the extensive rains have greatly injured the crops of wheat, oats, and hay that had been cut, causing the former to sprout, and rendering much of it unmarketable, while in other localities a continuous drought has materially lessened the chances for the growing crops, which were full of sap, and it will require very favorable conditions during the coming month to even partially restore them." W. U.

THE MEETING OF SWISS NATURALISTS.

The sixty-sixth annual reunion of the *Société helvétique des sciences naturelles* took place this year at Zurich, Aug. 6–9. As at all these Swiss meetings, discussions were happily mingled with daily banquets, at which toasts were offered to fatherland, to guests, and to the older honored names in Swiss science, — Studer, Heer, and Mousson, founders of the society. Sometimes German, and sometimes French, was spoken, and sometimes both by one speaker in the same speech. This year this venerable society gathered men of many countries, and Zurich received them cordially. Daubrée and Hébert of Paris were there; Lory of Grenoble, Credner of Dresden, Fritsch of Halle, Fontannes of Lyons, Hughes and Madame Hughes of Cambridge, Blanford of London, Dewalque of Liège, Kölliker and Fick of Wurzburg, Kundt of Strasburg, Clausius of Bonn, Szabo, Schuler, and Wartha of Budapest, Wislicenus of Wurzburg, Krauss of Stuttgart, von Hauer, Suess, Neumayr, Mojsisovics, and Goldschmidt of Vienna, Vilanova of Madrid, Beyrich and Richthofen of Berlin, Capellini of Bologna, Giordano of Rome, Wiedmann and His of Leipsic, and Seguin of New York.

From communications to the *Journal de Genève*, under initials which we presume to refer to the well-known physicist, Raoul Pictet, we glean the following account of the scientific sessions of the meeting, which began on the morning of Aug. 7.

Mr. Cramer, professor of botany at the university of Zurich, and president of the assembly, opened the meeting with a very noteworthy address before an interested audience of more than three hundred persons. He reviewed the chief progress of the natural sciences, and laid particular stress on the study of those minute organisms which constitute life within life, and whose appearance and development accompany epidemic diseases among men.

Reports on the various commissions (on finance, geology, geodesy, earthquakes, etc.) were followed by two communications from Profs. V. Meyer of Zurich and H. Fol of Geneva.

Mr. Meyer traced the progress of chemistry under the influence of the ideas of Mendelejeff and L. Mayer. He explained how these investigators had been able to classify all simple solids under five distinctly separated families. All these bodies are similar as to their general properties, the gradual increase of their atomic weights, the similarity of their chemical reactions, their atomic volume, etc. These likenesses are so striking, that the memorable discovery of gallium by M. Lecoq de Boisbaudran of Paris was foreseen three years before that simple body was separated. The density and atomic weight of this metal had been determined by calculation before its actual presence was demonstrated beyond doubt by the well-known experiments of the French chemist.

Professor Meyer concluded by showing the indebtedness of science to men who think, to men

who found theories on experiments, and then verify the truth of their hypotheses by renewed investigations. It is beyond question, that the labors of Mendelejeff and Meyer are the point of departure of a rational classification of matter, and that they have been a fertile source of useful chemical discoveries.

Professor Hermann Fol of the university of Geneva described his studies on animal individuality. In the lower animals, individuality is a different thing from what it is in the higher, such as the mammifers. But this law of individuality among the vertebrates is not without exception; and we all know the wonder which is excited by the sight of creatures with some member double, such as are often exhibited at shows, or may be seen in museums.

For a long time we have tried to explain the origin of these anomalies. Two theories have been proposed, — that of the creation of two distinct beings, and that of the partial division of one primitive simple. Neither of these theories quite accounts for the phenomena observed. The new and essential fact which Mr. Fol presented comes under the general law, that in these abnormal cases two heads always appear in the egg at the commencement of its development. The body forms immediately behind; and these two trunks, coming together, are so perfectly united that the two primitive heads are very near each other at the outset. In the first place, then, only the higher part of the body is duplicated in these montrosities; yet these two parts may become completely separated, resulting in twins, which so closely resemble each other that even the parents find difficulty in distinguishing them.

Mr. Fol has investigated the causes of the appearance of two embryos in one egg, by a very neat method. He asphyxiated the eggs of Echinus by immersion in Seltzer water (containing pure carbonic acid); and he ascertained that in this unhealthy condition, maintained for a moment, two germs at the instant of passage into life could simultaneously have birth.

Our individuality is one of our most cherished ideas. The great philosophers Descartes, Kant, etc., did not investigate even the possibility of a multiple individuality: it is interesting to observe the flexibility of that idea under the disturbing influence of special conditions of the origin of life.

Mr. Fol exhibited plates representing different kinds of montrosities: two heads and one body, a little body projecting from the eye of a child otherwise relatively well formed, etc.

Professor Herzen of Lausanne, in closing the session, invited all the doctors present to observe an exceedingly interesting case, — that of a man who was on the point of dying from hunger, the results of strangling, when M. de Cérenville of Lausanne began his experiments. This skilful surgeon arranged a stomachic fistula by which the man ate. He was regularly supplied with food, recovered his strength, and rapidly improved. Mr. Herzen took care of this man at his laboratory, and studied the phenomena of digestion according to the process which recalls the well-known Canadian case of M. de Beaumont.

The next morning the association met in sections in different halls. Unfortunately the gift of omnipresence was not given to man, and the members of one section could with difficulty glean here and there any knowledge of what was taking place in the neighboring halls. Besides it would take a volume to contain such a quantity of material, of which a *résumé* will appear in the September number of the *Archives des sciences physiques et naturelles.*

The following account treats only of the subjects taken up in the single section of physics.

Professor Clausius of Berne was elected, by acclamation, president; and Mr. Weber of Neuchâtel, secretary. Mr. F. A. Forel submitted a very interesting paper on the variations of temperature which the Swiss lakes undergo, from summer to winter, and from morning to night. It seems that in an average year the variations of temperature in the year are scarcely noticeable at a greater depth than 60 to 80 metres; above that, the surface of the water is for these lakes between 4° and 5.4°, the highest temperature corresponding to that of Lake Geneva. The variations are felt at a mean depth of ten metres.

After a lively discussion of the manner in which the currents of water influenced by these variations of temperature are set in motion, Prof. Charles Soret of the university of Geneva submitted the results obtained with his new apparatus, the refractometer. This first set of experiments dealt especially with the crystals of the alum-series whose radical is an alkaline metal. This very clear communication was especially remarkable for the skill with which the young professor set forth his subject with a great number of new facts in a comparatively short time. He was followed by his father, Prof. L. Soret, who presented a paper for Mr. L. E. Sarasin, and demonstrated by figures and curves the values of the index of refraction of fluor spar, a crystal, which, since the important works of Cornu and L. Soret, has taken so important a place in the construction of the achromatic lenses of spectroscopes. This paper was marked by extreme precision.

Mr. L. Soret presented a communication to the section of chemistry, belonging in great part to the section of physics. He set forth how the absorption bands seen in the spectra of solutions of albuminoid substances could be used in ascertaining the chemical nature of these solutions. These absorption bands are found especially in the ultra-violet; and, thanks to the fluorescent eye-piece invented by the speaker, their presence renders an analysis very rapid and simple.

Professor Clausius of Bonn gave us a lesson in mechanical electricity: he considered the problem of the production of electric currents by mechanical means. All the knowledge of this scholar, this enthusiastic and ingenious investigator, was necessary to obtain the final solution of so complicated a problem. The paper was heartily applauded.

Mr. Casimir de Candolle repeated, before the members who were present, some experiments to show how sand-ripples at the bottom of our lakes are formed. These facts were applied, in accordance with the ideas of Professor Strasburger of Bonn, to explain certain appearances of envelopes and vegetable cells in fossils.

Mr. Raoul Pictet presented an experimental demonstration of the second law of thermo-dynamics, deduced from the simultaneous working of steam-engines and frigorific apparatus.

Professor Weber of Zurich presented two interesting papers: one, on a dynamic method for the exact measurement of the coefficient of conductibility of heat in liquids; the other paper, on the apparatus for measuring electric units.

Mr. H. Dufour of Lausanne distributed among the audience a set of photographs showing the electric condition of the air, which were obtained by means of a registering electrometer in the new physical laboratory at Lausanne. These curves are so connected with the condition of the heavens, that it is no exaggeration to expect to predict the weather several days in advance, through a careful examination of the variations of electric tension of the air. For fine weather, the electric tension is strong; it sensibly decreases during and before storms; the rapid falling of the curve of the electric potential of the air is always an indication of rain or storm.

The late hour made it impossible to listen to five additional communications which had been announced. The boat for an excursion on the lake awaited its guests; science paled before the beauties of nature. Though continuing to converse on the subjects treated, we all together betook ourselves to the pier. The excursion was delightful. On our return, the streets were illuminated; Bengal and electric lights mingled their dazzling rays. The citizens of Zurich gave us a magnificent reception; and the *fête*, enlivened by an excellent orchestra, was continued to a late hour.

The next morning, Thursday, we listened to three scientific papers which closed the intellectual part of the reunion.

The honors of that morning belong to Professor Suess of Vienna. With consummate skill he set before us the chief points of the modern theory of the upheaval of mountains: he held his audience with great ease, and left a refreshing memory with all who heard him.

This paper, with that of Mr. Heer which followed, will be issued in full in the memoirs of the society.

The afternoon was given up to leave-takings. Seated around the long tables of the hotel L'Uetliberg, thanks and farewell were said again and again. Toasts of gratitude, toasts to the absent, to the present, to Clausius, to Mousson, Oswald Heer, and Studer, founders of the society, were applauded by all, glass in hand.

Appended to this account, appears a list of the principal papers offered in the other sections.

In the botanical section, Professor Heer spoke of the cretaceous and tertiary flora of Greenland; Mr. Schnetzler, of a Chinese primrose in which the sexual organs corresponded to an earlier stage in the evolution of Primulaceae, and on certain relations between an aërial alga and lichen; Mr. Favrat discussed the hybrids of two species of primrose and of other plants, and called attention to the changes in a Cardamines growing in turfy soil. Mr. Andreae spoke of pasturage on the Jura; and Mr. Casimir de Candolle drew attention to a curious Cytisus bearing both red and yellow flowers.

In the chemical section, Professor Krafft read a paper on the preparation of saturated alcohols; Professor Soret, on the absorption of the ultra-viole rays by the albuminoid substances; Professor Schulze, on the composition of cheese; and on phenylamido-propionic acid; Prof. Victor Meyer gave a new method for determining the vapor density of Cl. Br. I. for high temperatures, and reported on a new series of bodies, which he termed *thyophènes*, contained in benzol. Professor Wislicenus of Wurzburg offered a contribution to the theory of Van t'Hoff; and made a communication on the action of chloride of phtalyle and of phtalic anhydride on the ethers of malic acid; Professor Schaer recalled the forgotten works of De Saive (in 1756) on zinc combustion; Dr. Goldschmidt showed the action of hydroxylamine on ketones; Dr. Ceresole spoke of acetacetic acid; Professor Lunge, of the manufacture of sulphuric acid; Dr. Schumacher gave analyses of foods; and Dr. Urech exhibited a laboratory-lamp.

In the geological sections, papers were offered by Messrs. Favre, Neumayr, Schardt, Goll, Mühlberg, Fellenberg, Jaccard, Koch, Chevannes, Mösch, Fratech, and Suess.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Geology of Philadelphia.

In Dr. Frazer's notice of my lecture upon the geology of Philadelphia, there is so little of adverse criticism, that it may seem ungracious to reply to the few points regarded as blemishes. Merely in defence of the use made of certain terms called in question, a few words here may not be out of place.

In describing the Philadelphia gneiss as both Huronian and Mont Alban, there is no confusion, if, as is held by many geologists, the former term is generic, the latter specific.

The term 'creep,' as applied to the pulling-over of softened or broken strata downhill, by the action of gravity, frost, etc., is one frequently used in describing such phenomena in regions south of glacial action. It is used repeatedly in this sense, in a report issued by the Geological survey of Pennsylvania, in 1880.

The term 'hydro-mica slates,' objected to, is not only used by Rogers, Lesley, Dana, Hall, and others, but occurs repeatedly in Dr. Frazer's recent geological reports on Lancaster and Chester counties, being used by himself.

The positive statement regarding the absence of glaciation in Pennsylvania south of the terminal mo-

raine (the immediate 'fringe' in the western part of the state excepted) was made because of certain statements to the contrary quite recently made by a distinguished authority. It was made only after a thorough investigation of every locality supposed to be glaciated.

In conclusion, I may be permitted to say that while, owing to the necessarily limited length of a public lecture, the rocks of Philadelphia could not be so fully treated of as the superficial formations, this latter — and in this region more debatable — subject will form the topic of future lectures, which may perhaps be worthy of further comment by my friendly critic. HENRY CARVILL LEWIS.

Philadelphia, Sept. 7, 1883.

The pre-Cambrian rocks of Wales.

Those who are interested in the questions raised by Dr. Henry Hicks in his criticism of Professor Geikie in SCIENCE for Aug. 10, may find it to their advantage to consult my paper entitled 'History of some pre-Cambrian rocks in Europe and America,' which appeared in the *American journal of science* for April, 1880 (vol. xix. p. 268–283). I had the good fortune, in 1878, to spend several days with Dr. Hicks, in going over the typical localities previously studied by him, not only at and near St. Davids in South Wales, but also those of Carnarvon, Dinorwic, and Anglesea, Messrs. Tosell and Tawney being our companions, in North Wales. As a result of these studies, I am satisfied that the views of Messrs. Hicks and Hughes are correct, and their criticisms of Professor Geikie well founded.

The Dimetian, alike in North and South Wales and in Anglesea, has both the lithogical characters and the stratigraphical relations of the Laurentian of North America. The Arvonian corresponds in like manner to the great series of *hälleflintas* or petrosilex rocks, jaspery and porphyritic, whose distribution on the coast of Massachusetts and of New Brunswick, in the Blue Ridge of Pennsylvania, in Missouri, and on Lake Superior, I have studied and elsewhere discussed (*Second geol. surv. Penn.*, rep. E, p. 189–195). Similar rocks have also been described by Irving in the Baraboo river in central Wisconsin, a locality which I have lately had an opportunity of examining. The conglomerates of Arvonian pebbles, which form the basal beds of the Cambrian near Snowdon, are indistinguishable from those found at Marblehead and elsewhere on our eastern coast, lying on or near the Arvonian.

The Pebidian of Hicks is our typical Huronian, as seen in eastern Canada and around the lakes Huron and Superior. Professor Bonney, who has lately received a collection of these, is struck with their complete resemblance to the Welsh Pebidian which I had seen and called Huronian thirteen years since. The succeeding gneisses and mica-schists (upper Pebidian or Grampian of Hicks, and Caledonian of Callaway), which are our Montalban series, are not met with in Wales, but appear not only in Scotland, but, as I have pointed out, across the channel, in the Dublin and Wicklow hills in Ireland.

The similar succession in the Alps, I have described in a late paper, of which an abstract appeared in SCIENCE for Sept. 7 (p. 322). The student who compares the succession of stratified crystalline rocks alike in North America, in the British Islands, and in southern Europe, can scarcely fail to recognize, in their constant stratigraphical and lithological relations, something like a 'universal law.'

T. STERRY HUNT.

Montreal, Sept. 11, 1883.

SERGEANT FINLEY'S TORNADO STUDIES.

Report on the character of six hundred tornadoes. Professional papers of the signal service, No. vii. By J. P. FINLEY, Washington, *Signal service*, 1882. 19 p., 3 maps, 4°.

Tornadoes: Their special characteristics and dangers. By J. P. FINLEY. Kansas City, 1882. 30 p.

So striking a phenomenon as a tornado, and one so destructive in its effects, would naturally receive much attention; yet, curiously enough, the competent treatment which these storms have received is remarkably inadequate. Those omniscient gentlemen, the reporters of the newspapers, have written much about tornadoes, and many columns of our summer dailies are filled with accounts of them; but, aside from the books of Peltier and Reye, the scientific literature is fragmentary. Half a century ago, at the time of the battle between Reid, Redfield, Piddington, Espy, Hare, and others, over the rotatory theory of storms, the tornado-literature took a considerable development; but it soon fell to small dimensions, and here it has remained until quite recently. The present activity in this field is largely due to the signal service, and Sergeant Finley's contributions form an important part of the current literature.

Mr. Finley's specialty is the collection of facts concerning tornadoes. He has accounts of individual tornadoes in many of the annual reports of the chief signal officer. They represent the facts collected by him on the field of destruction itself. They are evidently gotten together with great care; measurements are made when practicable, and explanatory maps and sketches are numerous. His evident object is to put before the reader the accurate representation of what he saw, encumbered as little as possible by explanatory theories. The result is that his reports are interesting reading, and afford a mine of wealth for the future Kepler of tornadoes.

Not quite so important, perhaps, from a scientific point of view, but of far more general interest, is his report. Its principal feature is the tabulation of the tornadoes discussed, with headings for time, dimensions, velocity, clouds, and other meteorological features. These are summed up, and from the results are drawn various interesting conclusions concerning maxima, minima, and averages.

Mr. Finley's search for accounts of tornadoes has been extensive; but as he has unfortunately given no references, we cannot tell how extensive it may have been. Evidently he has not gone through the Proceedings of the Amer-

ican association for the advancement of science, or he would have found the tornado of Aug. 9, 1851, in Connecticut, recorded, and that of May 3, 1868, at Shanghai, Ill. Nor has he searched through the state agricultural reports, where he would have found that of June 3, 1860, in Illinois, and doubtless others. Again, Niles's American register gives one at Keene, N.H., on July 25, 1807, and at Knoxville, Tenn., on May 25, 1808. The Philosophical transactions would have yielded him one in New England, July 10, 1760; and several others could have been picked up in Blodgett, Piddington, and in the *American journal of science*. Even that of May 22, 1873, in Illinois and Iowa, reported in the publications of his service for 1873, seems to have escaped his attention.

As average results like those deduced by Mr. Finley depend for their value on the number of individual cases taken into consideration, would it not have been wise for him to have collated those occurring in other countries, so far as they were accessible without difficulty? Peltier would have yielded him quite a crop, some of which, by the way, come curiously near home. Other text-books would have given other European ones; and Chinese and African ones have been described, the latter frequently. Tornadoes are by no means exclusively American; and by a comparison with those in the other countries their essential features could be more easily sifted out, and the incidental ones given their proper prominence.

In the pamphlet, 'Tornadoes, their special characteristics and dangers,' the author classifies the rotatory storms. It was in the pursuit of a classification of storms, that he first had his attention called to the insufficiency of our knowledge of this species. Tornadoes are here described in some detail, and numerous directions given for the protection of life and property on their occurrence. It is the best description of the storm known to the writer.

Mr. Finley considers the tornado a much better-defined species than is likely to be acknowledged by meteorologists generally. Right names are extremely useful, but we must not permit them to conceal any underlying unity. By his anxiety to get a clear species, the author shuts out the light which he might get from the study of storms of so similar character that one is compelled to believe that their differences are due only to difference in surroundings. Thus water-spouts are only tornadoes on the water, with circumstances remarkably favorable for observation. They occur not infrequently on the Great Lakes, and the change from tornado to water-spout has been observed more than once. Judging from the only description known to me of the riband storms of British North America (*Cosmos*, 2d series, iii. 274, 275), they are also somewhat modified tornadoes. And while the name cloudburst refers rather to a single feature of subordinate meteorological importance, the phenomenon is probably often of tornado character. Indeed, leaving out of account eddies, which it is not, the tornado differs only quantitatively from the other members of that list of storms which begins with the formation of a cumulus cloud, passes on to thunderstorms and hailstorms, and culminates in the 'low-centre,' the hurricane, and the typhoon. They all find their origin in the transformations of water; and to overlook the relations they have to each other, is to refuse assistance in a problem well-nigh insoluble with that assistance.

It is expressly stated (see p. 4 of the last-mentioned pamphlet), that the gyratory motion is always from right to left. The writer would point out the exceeding difficulties which surround the determination of this point. Some of the early observers saw only indications of a radial inpour, and in the descriptions of tornadoes one frequently finds dextral whirls mentioned. In so small a storm, the earth's rotation would surely have no appreciable disturbing effect; and that, in a difference of latitude of only a few rods, it should originate velocities of a hundred or more miles an hour, is so unlikely that it need hardly be considered. Furthermore on p. 7 the author admits variations in the gyration of the tornado's other self, — the water-spout. So, while unwilling to differ from so experienced an observer on such a point, both the records and general considerations lead the writer to think that the direction of gyration may be indifferently dextral or sinistral.

There is one possible feature of tornadoes which has not yet been definitely proven, but of which we ought now to be able to ascertain the truth or falseness by an investigation like that just discussed; viz., Are tornadoes disposed to return on the same path? The writer spent his childhood in northern Illinois, where heavy hail and other tornado-like storms are not rare. He remembers several instances of their following the exact path of their predecessors. Professor Whitfield (*Amer. journ. sc.*, 3d series, ii. 99) says in regard to southern tornadoes, "It is not an established fact, but it is commonly believed, and with some reason, that the tornado does, in the course of years, return along its beaten path, and that

it is unsafe to build where one has ever passed. The house in Pickens county stood on a hill from which a log-cabin had been blown away some thirty years before. I witnessed the last of three, which have passed along the same track. Near Hernando, Miss., three have followed an unvarying line." He suggests that some places are more favorable than others for the production of these storms, which would make them of a more local character than Mr. Finley would be willing to admit.

While Mr. Finley's work, like that of all others, is capable of improvement, the writer believes he has done great service to this branch of science, and deserves the sincere gratitude of both the student of science and the resident in tornado districts. In enabling him to pursue his investigations, the signal service deserves the commendation of the scientific and general public.

ZIEGLER'S PATHOLOGICAL ANATOMY.

A text-book of pathological anatomy and pathogenesis. By ERNST ZIEGLER; translated by Donald McAlister. London, *Macmillan*, 1883. 360 p. 8°.

THIS book is a translation, from the German, of a portion of Professor Ziegler's work on pathological anatomy, which appeared two years ago. The work is not as yet completed in German, nor does the translation contain all that has yet been published, covering only the ground of general pathological anatomy.

Professor Ziegler is a young man who has already gained distinction in Germany by his original investigations in connection with tuberculosis and certain of the processes involved in inflammation.

The scope of the present work is to afford to students and physicians a text-book which shall give a short and concise statement of what is known upon the subjects treated, including the results of the most recent investigations.

The book opens with a section of three chapters on malformations. This is condensed and dry; and further, as there are no plates to illustrate the monstrosities, the student wishing to acquire a knowledge of this difficult subject will do better to fall back upon the earlier monographs of I. G. St. Hilaire, Foerster, and Ahlfeld.

Then follow four chapters on the pathology of the blood and lymph, which, though short, are very good, containing essentially what is known upon the subject. Very little space is devoted to thrombosis and embolism; but this is not a neglect on Ziegler's part, as he treats of it in detail in that portion of the book which has not yet been translated.

The succeeding chapters on the retrograde disturbances of nutrition are worthy of much praise, giving as they do a very clear, though concise, account of these changes, including also the results of the latest work on coagulation-necrosis.

The chapter on cysts, consisting of but a single page, is incomplete, and does not treat with sufficient fulness this important subject.

The three chapters devoted to hyperplasia, regeneration, and metaplasia of tissues, give a good account of the somewhat meagre knowledge on these points.

In treating of inflammation, the author gives a short historical sketch of the ideas held at various times upon the conditions present in this process, and then devotes considerable space to the ideas now in vogue, as expressed by Cohnheim, Samuel, and others; the exudation from the vessels, due to presumable changes in the vessel-wall, now forming the anatomical basis. The parenchymatous inflammations of Virchow find no place in the category, nor will Ziegler allow that the connective-tissue corpuscles take any part in the process, as advanced by Virchow, and still maintained by von Recklinghausen.

The secondary changes occurring in the products of an inflammation are well treated; a point in regard to which Ziegler has himself contributed some original work.

The infective granulomata are removed from the category of tumors, and are classed with the inflammations. Under this head are considered tubercle, syphilis, leprosy, glanders, lupus, and actinomycosis.

The anatomy of tubercle and its development are fully and well treated, and the relation of the Bacillus tuberculosis to the disease detailed so far as the present knowledge permits.

Virchow's classification of tumors is adopted, with the exception, as already stated, of the omission of the granulation-tumors. In reference to the aetiology of tumors, the author does not regard Cohnheim's embryonic-foci theory as sufficient to explain all cases, though undoubtedly applicable to many.

Of the increasing importance of the subject of parasites in relation to disease, no better proof is to be found than in the greater number of pages devoted to this point in the newer books; and among the parasites the Schizomycetes claim the lion's share of attention.

The author gives Cohn's classification of the latter, together with a description of their gen-

eral morphological characters. He then devotes considerable space to a consideration of the conditions, such as temperature, nutritive substances, and the like, favoring their growth; their effect in causing the groups of changes included under the terms fermentation and putrefaction; finally, discusses their relation to disease. Of their method of action, he very properly refrains from expressing an opinion.

The list of pathogenic microbia, according to Ziegler, is a larger one than the strictly cautious observer will admit. For, to go beyond as a proven fact that specific organisms have been found in connection with other diseases than anthrax, relapsing fever, septicaemia of mice, and probably with tuberculosis, glanders, malignant oedema, and, under the Hyphomycetes, actinomykosis, is, in the present state of our knowledge, unwarrantable.

In regard to the mutability of bacteria, the views of various writers *pro* and *con* are given, but no definite conclusion is expressed.

To the Hyphomycetes a chapter is devoted; and, while giving a very good account of what is known in regard to their pathogenic qualities, one can but be impressed with the fact of the extreme meagreness of knowledge of the relation which the ever-present mould-fungi bear to disease.

The chapter on animal parasites contains nothing of special interest.

The book as a whole shows evidence of having been written by a young man. All that is new has special stress laid upon it, while the work of the earlier generation receives less attention. The author inclines to state things positively, with but little of the cautious scepticism which marks the writings of the older and more conservative worker who is prepared to weigh every objection, and combat every point.

This latter quality, however, does not in the least detract from the value of the work, for the object for which it was intended; on the contrary, much enhances it. For nothing can be more disheartening to the student beginning a subject, than to be plunged at first into that mire of doubt which is ever present for him who attempts a deeper insight into a science.

The English translation is a remarkably good one. It is certainly as agreeable as it is rare, to read a smooth translation, where one is not constantly reminded of the tongue from which it had its origin.

The letter-press and wood-cuts are much superior to those usually found in text-books; and Macmillan deserves with Dr. McAlister the thanks of the English-reading profession for presenting Professor Ziegler's work in so attractive and readable a form.

As a text-book for students, physicians, and those men of science who are interested in the sciences upon which medicine rests, it fills a gap which has long been felt.

ECONOMIC ENTOMOLOGY IN ENGLAND.

Report of observations of injurious insects during the year 1882, with methods of prevention and remedy, and special report on wire-worms. By Eleanor A. Ormerod, F. M. S, etc. London, 1883. 98 p., illustr. 8°.

This is the fourth of a series of reports prepared by Miss Ormerod for the use of the farmers of Great Britain. The plan of these reports is peculiar. They consist largely of abstracts from the writer's correspondence; the greater part of which is presumably in reply to circulars issued by her. In thus collecting and publishing the results of the experience of the more observing agriculturists, Miss Ormerod is doing an important work, and the enthusiasm and energy which she has displayed in it are deserving great praise. It is fortunate, however, that she has not confined herself to the work of compilation, but has recorded the results of personal observations. And we venture to suggest that what she states on her own authority will be read with more interest than the quoted portions of her work. For no one but herself can judge of the relative value of the conclusions of her various correspondents. We realize, however, that the publication of the reports of these correspondents is probably a considerable part of the incentive to their co-operation with her; and the system has produced such good results that one should be slow to criticise it.

The report for 1882 contains notes on more than thirty different species of insects infesting fruit, garden-vegetables, field-crops, and forest-trees. The most serious injury recorded for that year is that to hops by Aphides. It is estimated that the loss to the hop-growers of the United Kingdom from this cause was not less than £1,750,000. This injury is the greatest which has been incurred for many years.

Nearly one-half of the report is devoted to an article on wire-worms, or click beetles. This article was compiled from notes contributed in reply to a circular issued by the council of the Royal agricultural society, and it doubtless gives a very good idea of the popular beliefs now held in the British isles respecting these pests. We wish that the above-named society

would now afford their entomologist, Miss Ormerod, an opportunity for directing a series of comparative experiments to test the truth of these beliefs.

The report is well illustrated, partially by some of the well-known figures of Curtis, and partially by original figures drawn by the authoress.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

The elliptic differential equation. — M. Rud. Sturm has here given a method of integration for the general elliptic differential equation $\frac{dx}{\sqrt{X}} \pm \frac{dy}{\sqrt{Y}} = 0$, where X and Y are quartic functions of x and y respectively, say, $X = E(x-a)(x-b)(x-c)(x-d)$, and Y a similar function of y. He shows that this equation can be integrated directly by aid of an integrating factor which he determines. Denoting by $X_{ab} \ldots Y_{ab} \ldots$ the products of two of the factors $x-a, x-b \ldots, y-a, y-b \ldots$, then the left-hand side of the equation $\frac{dx}{\sqrt{X}} \pm \frac{dy}{\sqrt{Y}} = 0$ is made the exact differential of

$$\frac{1}{x-y}\left\{\sqrt{X_{ab}Y_{cd}} \mp \sqrt{X_{cd}Y_{ab}}\right\}$$

by multiplying it by the quantity

$$\frac{1}{(x-y)^2}\left\{[\tfrac{1}{2}(x+y)(a+b) - xy - ab]\sqrt{X_{cd}Y_{ab}}\right.$$
$$\left. \mp [\tfrac{1}{2}(x+y)(c+d) - xy - cd]\sqrt{X_{ab}Y_{cd}}\right\}.$$

— (*Math. ann.*, xxi.) T. C. [238

PHYSICS.

Electricity.

Efficiency of telephones. — K. Vierordt measures the weakening of sound through telephones by diminishing the sound at the transmitter until it just becomes inaudible at the other end. The sound is measured by the mass and height of a small leaden sphere, which is dropped upon a tin plate. Using two Siemens-Halske telephones, of 205 and 208 S. U. resistance respectively, he found that the loss over thirty-four m. of wire was less than seventy-five per cent of the loss in air. — (*Ann. phys. chem.*, xix. 207.) J. T. [239

Electric lighting. — Ganz & Co. of Budapesth find, that, with a continuous current, the carbon filament of an incandescent lamp gives out first at the end where the positive current enters, a spot of carbon being deposited on the neighboring part of the glass. If alternating machines are used, the life of the lamp is almost exactly doubled, and when the deposit forms it is all around the case. — (*Engineering*, June 15.) J. T. [240

ENGINEERING.

A great 'Sound steamer.' — The steamer Pilgrim, of the Old Colony steamship company, was recently added to the fleet now plying through Long Island Sound. The vessel is the largest and the most expensively fitted up of all steamers which have yet been built for those waters. The hull is of iron, double, and built in compartments. The boiler space is so enclosed by iron bulkheads that the danger of fire is wholly avoided. The engines are of the standard beam-engine type, and fitted with the Stevens valve-gear. They were designed by Messrs. Fletcher & Harrison, and built by Messrs. John Roach & Son. The steering is done by means of a Sickles steam steering gear, and the lighting is performed by Edison dynamos. The hull is 390 feet long on deck, 375 on the load line; the beam is 50 feet over the hull and 87.6 feet over the 'guards;' the depth of hold is 18.6 feet; draught of water, 11 feet. The engine has a steam-cylinder 110 inches in diameter and 14 feet stroke of piston. There are 12 boilers of steel, and calculated for a pressure of 50 pounds per square inch. The total power is estimated at 5,500-horse power. The wheels are of the radial type, and are 41 feet in diameter, weighing 85 tons each. The shafts are 26 inches in diameter. The cylinder weighs 30 tons; the bed-plate, 30 tons; the beam, 33 tons; the condenser, 60 tons. The machinery will weigh, altogether, with water in the boilers, 1,365 tons. There are 103 water-tight compartments; and it is considered that it will be impossible to sink the vessel by collision or grounding. There are 912 electric lamps operated by two Edison dynamos of a total of 11,400-candle power. They are driven by an Armington & Sims engine, built at Providence, of 150-horse power. The grand saloon is the largest in the world: it is 350 feet long, and accommodates 1,400 passengers, for whom state-rooms are provided. — (*Sc. Amer.*, June 30.) R. H. T. [241

CHEMISTRY.

(*General, physical, and inorganic.*)

Apatites containing iodine. — In continuing the study of the formation of artificial apatites, A. Ditte fused baric iodide with a mixture of sodic iodide and ammonic phosphate, the latter in small quantity. On slow cooling, the mass crystallized in hexagonal prisms of the composition $BaI_2 . 3\,Ba_3(PO_4)_2$. When ammonic arseniate was substituted for the phosphate, the corresponding iodarseniate, $BaI_2 . 3\,Ba_3(AsO_4)_2$, was formed. The iodvanadate, $BaI_2 . 3\,Ba_3(VO_4)_2$, crystallized in transparent prisms. The strontium compounds, $SrI_2 . 3\,Sr_3(PO_4)_2$, and $SrI_2 . 3\,Sr_3(AsO_4)_2$, and calcic iodvanadate, $CaI_2 . 3\,Ca_3(VO_4)_2$, were obtained. — (*Comptes rendus*, xcvi. 1226.) C. F. M. [242

The spectrum of beryllium. — Mr. H. N. Hadley finds that the spectrum of beryllium shows no marked analogy with the spectrum of calcium, mag-

nesium, or aluminum. It does not resemble the spectrum of carbon, boron, or silicon; but it is more closely allied to that of lithium. The author therefore concludes that it is the first member of a dyad series of elements homologous to calcium, strontium, and barium. — (*Journ. chem. soc.*, June, 1883.) C. F. M. [243

Decomposition of water by the metalloids. — When distilled water is boiled with sulphur, C. Z. Cross and A. F. Higgin find that it is decomposed according to the equation $2H_2O+3S=2H_2S+SO_2$. They also noted that sulphur distilled with steam or with the vapor of dilute alcohol. On boiling arsenic with water, it was converted into arsenious acid and hydric arsenide. Arsenious sulphide was changed into a sulfoxy-compound. — (*Berichte deutsch. chem. gesellsch.*, xvi. 1195.) C. F. M. [244

Pyronome. — This is the name given by M. Sandoy to a new explosive, consisting of sixty-nine parts of saltpetre, nine of sulphur, ten of charcoal, eight of metallic antimony, five of potassium chlorate, four of rye-flour, and a very small quantity of potassium chromate. The materials are mixed with an equal quantity of boiling water, and the mass is evaporated to a paste, dried, and powdered as wanted. This mixture is said to be much cheaper than dynamite, but its manufacture and use must be attended with considerable danger. — (*Chem. techn. rep.*, 1883, 154.) C. E. M. [245

METALLURGY.

Gaseous fuel in iron manufacture. — Mr. W. S. Sutherland read a paper before the British iron and steel institute, on the production and utilization of gaseous fuel in iron manufacture, in which he claims that the seams of boilers can be welded instead of riveted, if the heat can be applied uniformly, and of sufficiently high temperature, without excess of air or admission of dirt. This kind of heat he has obtained only by the use of coal-gas, Siemens-producer gas, or water-gas, the preference being given to the latter. To secure the requisite air in constant proportion, the gas being in excess, gas and air are mixed before combustion; probably the first instance of such a utilization of the principles of a Bunsen burner on a large scale. Explosions are prevented by having an outlet lightly covered by india-rubber, at some corner of the main; and when the wave, or disk of flame, which does not readily turn a corner, reaches this cover, it breaks the rubber just as a blow would. The method has been worked some ten years without accident. From all his experience, Mr. Sutherland concludes, that to produce a good, true, wrought iron, Siemens gas with varying proportion of air, instead of air alone, should be blown into the iron in the Bessemer converter. — (*Eng. min. journ.*, July 14, 21.) R. H. R. [246

Nickel extraction. — Prat and Laroche of Bordeaux add powdered nickel ore to a bath of sulphuric acid 56° to 66° Baumé: on stirring the mass it becomes heated, and in half an hour it is nearly solid. The soluble salts of the metals, thus formed, are leached out with boiling water. From this solution, oxalate of nickel is formed by boiling with oxalic acid; the precipitated oxalate of nickel is boiled with caustic soda, yielding oxide of nickel and oxalate of soda. The oxalic acid is recovered from the latter salt. — (*Eng. min. journ.*, June 2.) R. H. R. [247

The Doetsh copper extraction process. — This process has been in use by the Rio Tinto mine for some years. The ore is crushed to .4 inch in size, and piled in heaps forty-five feet wide, with suitable channels at the bottom, and vertical draught-holes. About two per cent of salt is sprinkled over the top. A basin thirty feet square is made on the top of the heap, and the regenerated liquors from the last operation are run into it. The dissolved and leached copper is precipitated by scrap iron, the iron liquors remaining are regenerated by sprinkling them down through a coke tower, while mixed chlorine and hydrochloric acid are forced upward. — (*Eng. min. journ.*, July 14.) R. H. R. [248

MINERALOGY.

Picro-epidote. — MM. Damour and Des Cloizeaux have investigated a gray crystalline mineral from Lake Baikal, and found it closely related to epidote in crystalline form and optical properties. A complete chemical analysis was not made; but qualitative tests proved it to be a silicate of alumina and magnesia, with only a trace of calcium. It is supposed to be a magnesium epidote, and the name 'picro-epidote' is proposed for it. — (*Bull. soc. min.*, vi. 23.) S. L. P. [249

Jeremeieffite. — A new mineral from the Soktoui, south-east of Adun-Tschilon in western Siberia, has been described by M. Damour. It occurs in nearly colorless, transparent, hexagonal prisms, thus resembling some varieties of beryl and apatite. Hardness, 6.5; specific gravity, 3 28. Qualitative analysis proved it to be essentially a borate of alumina. Before the blowpipe it is infusible, loses its transparency, and colors the flame green (boron); with cobalt solution, it assumes a blue color. It is insoluble in acids, except after strong ignition, when sulphuric acid dissolves it. Chemical analysis yielded B_2O_3, by difference (40.19) . Al_2O_3 (55.03) . Fe_2O_3 (4.08) . K_2O (0.70) = 100%, from which the formula $(Al, Fe)_2 B_2O_6$ is derived. It is named after the Russian mining engineer, Mr. Jeremejew. — (*Bull. soc. min.*, vi. 20.) S. L. P. [250

METEOROLOGY.

Bavarian meteorology. — The quarterly publications of the meteorological stations in Bavaria deserve special mention for the model way in which the observations are recorded, and for the excellent discussions which accompany them. The concluding number of the series for 1882 contains a monograph by Dr. Lang upon the observations at Munich for sixty-seven years. Among the results reached is that the mean pressure for any day can be better obtained by taking the mean of the observations at six A.M., two and ten P.M., than by any other of the eight different combinations tested. The mean of the maximum and minimum for the day gives in general nearly as good a result. Similarly of the tempera-

ture, the best combination is the mean of the seven A.M., two and nine P.M. observations, but the mean of the maximum and minimum is nearly as good. — (*Beob. met. stat. in Bayern*, iv. 4.) W. U. [251

Rainfall at Hawaii. — The meteorological conditions of the island of Hawaii are so peculiar, that, though the island is not large, in one portion rain seldom falls, and the land is a desert; while in another the rainfall is so excessive that it is said it should be measured, not in inches, but in feet. In proof of the excessive rainfall, the following figures have been furnished by Dr. C. S. Kittredge of Hilo, Hawaii. The observations were made by Dr. Wetmore at Hilo.

Rainfall at Hilo, Hawaii.

	1880.	1881.	1882.	1883.
	In.	In.	In.	In.
January	–	5.1	36.7	3.1
February	–	3.1	23.6	23.1
March	–	55.2	18.7	2.4
April	14.5	8.3	5.2	12.4
May	6.9	4.2	7.0	–
June	8.1	10.8	7.1	–
July	22.1	9.9	7.9	–
August	7.3	8.8	7.0	–
September	14.5	8 2	8.6	–
October	15.7	4.9	6.9	–
November	3.6	21.7	20.4	–
December	3.1	34.2	15.7	–
Sums	–	174.4	164.8	–

For the three years April 1, 1880 to April 1, 1883, the total amount is 463.6 inches, averaging 154.5 inches each year. — W. U. [252

GEOGRAPHY.

(*Arctic.*)

North-west America. — Reports from the island of Kadiak, Alaska, state that the spring has been unusually late, and on the 6th of June summer seemed to have just set in. During the preceding three months, the rainfall had averaged eleven inches per month. Salmon-canneries had been established at Karluk, on the island of Kadiak, and at Seal bay, Afognak island. On Cook's inlet, a cannery had been established at the Kassilax river. Exploring parties were examining the shores of the inlet for minerals. One party was ascending the Sushitno river, where Doroschin reported gold many years ago. Another party had sailed for Kamishak bay, Aliaska peninsula. An experiment in sheep-raising has been going on, on the island of Kadiak, for three years. Success seemed certain, as the wool improved in quantity and quality, and was free from burrs and impurities. In adding to the number, an epidemic disease was introduced; and of the flock of three hundred, only about thirty survived. —— Rev. S. Hall Young has been making a study of the religious belief of the T'linkit Indians of the Alexander archipelago, which will shortly be made public. —— The U. S. revenue-steamer *Corwin* left Sitka on her Arctic cruise, June 16. —— At Juneau City, the largest shipment of gold-dust ever made was sent by the June steamer. The troubles among the miners here have caused many to depart. It appears that the rock containing the gold is of a loosely crystalline or granular nature, which weathers to a gravel. The lighter portions of this wash away in the rains; but the gold settles down into the remainder, which becomes much richer than the original rock in equal quantities. This gravel is said to exist on the upper parts of the auriferous mountain-belt. Prospectors claim this gravel as placers, and desire to work it under the law governing placer-mining. The companies who have taken up quartz-claims desire to have it regarded as quartz or vein mineral: hence the conflict, which was to have been settled by the officers of the U. S. S. *Corwin*. The decision has not been made public. —— Prospectors have gone to explore the country about Yakutat bay, where the Indians have hitherto been hostile. Reports as to its richness in gold have long been prevalent; but so many have met their death from the natives, that hitherto no one has dared attempt exploration. The party consists of five men, with six months' provisions, and was transported by the U. S. S. *Adams*. The prestige of the naval vessel, it is hoped, will afford them protection. —— The schooner *Alaska* has sailed from San Francisco, for Golovine sound, Alaska, taking with her a small stern-wheel steamer and a complete mining equipment and some twenty-five miners. The mines are situated on the Fish river, which forms part of the water-communication between Grantley harbor and Golovine sound. It is stated that the ore is a very rich argentiferous galena. The parties engaged in the enterprise have been several years investigating the deposit, and feel sufficiently encouraged to begin a regular prosecution of the business. In this vicinity, graphite is known to occur in a sienitic rock, in considerable quantities. This will be the most northern mine actually worked in the western hemisphere. — W. H. D. [253

(*South America.*)

Bove's new expedition. — Lieut. Bove proposes a new expedition to complete studies begun during his last journey in the southern part of the Argentine republic. He proposes to investigate the present physical and economic condition of the country, with a view to closer commercial relations with Italy. He will take up the exploration of Patagonia and Tierra del Fuego, especially the basin of Santa Cruz, the canals of western Patagonia, and the habitable country extending from the Ona to the Cioniu Chonos. The inhabitants are totally unknown. The explorer has placed himself at the disposition of the Argentine government for the purpose of placing light-houses on Staten island and other points needful for navigation, an arrangement which will facilitate the prosecution of his other investigations. For transportation he will depend partly on the English missionary board, who have promised co-operation, and will afterward equip for exploration one of the small vessels always obtainable for such purposes either at the Falkland islands or Punta Arenas. The journey will occupy a year, and cost about five thousand dollars. — (*Revue géogr.* June, 1883.) W. H. D. [254

BOTANY.

Ellis' North American fungi. — Dr. Farlow, who edited the third and, in part, the eleventh century of this collection, contributes valuable notes on some of the Peronosporeae and Uredineae so far distributed, with some pertinent remarks on the nomenclature of the latter group. Though desirous of retaining the earliest specific names wherever practicable, the writer does not believe, with Winter, in applying the name given to the Aecidium of a Puccinia or other teleutosporic form to the species, when its several stages are grouped under the generic name of the latter form. "For practical reasons, if for no other, the custom of substituting an aecidial specific name, for a name given to a Uredo or teleutosporic form, should by all means be avoided. Of all the Uredineae described by older writers, probably none are more difficult to determine satisfactorily at the present day than the species of Aecidium, so called. Original specimens of that genus are, as a rule, not so well preserved as those of other genera of the order; and, if one usually gets little satisfaction from examination of what is left of the original types, he is scarcely better off on reading the older descriptions. It was not unfrequently the habit of older mycologists, to describe as varieties of one Aecidium forms found on the most diverse plants; and most certainly it is going too far to substitute for the name of a Puccinia, let us say, which has passed current for many years, the name given by an old authority, like Persoon or Link, to what he considered a variety of an ill-defined Aecidium. It cannot be said that any want of respect to the older writers is shown by abandoning their aecidial names in such cases."

With respect to the Uredo name, however, the case is held to be somewhat different. "As a matter of fact, the types of the earlier-described Uredo forms are much better preserved than Aecidia, and examinations of older herbaria frequently enable one to determine with accuracy what form was meant by an older author. Furthermore, the Uredo and teleutosporic forms frequently are found together in the same sorus, or in close proximity; and examinations of authentic specimens often show the relation of an old-described Uredo to a more recently described teleutosporic form. The most important consideration, however, is the following. Many of the forms now recognized as teleutosporic have one-celled spores, and were originally described as forms of Uredo; and, in such cases, one must go back to the original specific names." He adds, however, "If I have advocated retaining the older Uredo name in cases where we know with certainty what was meant by the earlier mycologists, I have by no means intended encouraging the use of names about which there is doubt, either from the absence of typical specimens, or confusion of several species by older writers. Rather than favor that method — if one may say so — of forcing priority, I should prefer to give up the substitution of all old Uredo names, except, possibly, in the case of species now referred to Uromyces." The use of the parenthesis for the original authority for the species, though somewhat cumbrous and generally discarded by phenogamic botanists, is, on the whole, advocated, especially since the genera of fungi are often not very definitely fixed. "A species of Fries, for instance, may, during five years, be dragged through no one knows how many new genera; and it is with a mildly malicious satisfaction that one sees those modern writers who adopt minute generic subdivision, forced by the prevailing custom to add the '(*Fr.*)' as a slight tribute to the past."

Besides the characters of eight species, previously nondescript, the notes also contain much critical information concerning the synonymy of many of the species, and the geographical distribution of others. An interesting fact is the preponderance, among our Peronosporae, of species germinating by the production of zoöspores, though this would appear to better adapt them to an insular climate than to ours, which is a continental one, subject to extremes of heat and moisture. — (*Proc. Amer. acad.*, May 9, 1883.) W. T. [255

ZOÖLOGY.

Crustacea.

Parasite of the salmon. — Carl F. Gissler in an anonymous article, in the *American naturalist* for August, describes and figures, as a new species of Caligus, a parasite of the salmon of Puget sound. The species is probably Lepeophtheirus salmonis, which infests the salmon upon both sides of the North Atlantic. — S. I. S. [256

Brachyura and Anomura off the coast of New England. — In a preliminary report on the Brachyura and Anomura dredged in deep water off the south coast of New England by the U. S. fish commission in 1880–82, S. I. Smith enumerates thirty-one species taken in sixty-five to six hundred and forty fathoms, and gives full descriptions and figures of the new forms discovered. The report, although only a supplement to a notice of the crustacea dredged in the same region in 1880, describes three new genera and seven new species. Of the thirty-one species enumerated, only four were known from the south coast of New England previous to 1880, and more than half of the whole number were new to science; and yet none of the species belong to the abyssal fauna proper, and nearly all of them were taken most abundantly in less than two hundred fathoms. The dredgings off Martha's Vineyard in 1882 revealed the total, or almost total, disappearance of several of the larger species of crustacea, which were exceedingly abundant, in the same region, in 1880 and 1881. The disappearance of these species was apparently connected directly with the disappearance of the tile-fish (Lopholatilus) from the same region; and on this account complete tables are given of the specimens examined from all the dredgings in the region in question. Five species, which were exceedingly abundant in 1880 and 1881, were not found, or found only very rarely, in 1882; and five others, taken several times in 1880 and 1881, were not taken at all in 1882. These species were specially characteristic of the narrow belt of comparatively warm

water, — in sixty to one hundred and sixty fathoms, — which has a more southern fauna than the colder waters either side. Professor Verrill has suggested that there was a great destruction of life in this belt in the winter of 1881–82, caused by a severe storm agitating the bottom-water, and forcing outward the cold water that occupies the great area of shallow sea along the coast, thus causing a sudden lowering of the temperature along the warm belt.

Among the forms described are two new genera of Galatheidæ, in one of which there are no appendages on any of the first five abdominal somites of the adult male. But the most interesting forms are two genera of hermit-crabs, — Parapagurus and Sympagurus, — in which the branchiae present types of structure intermediate between the phyllobranchiae of ordinary paguroids, and the trichobranchiae of the Astacidae, etc. — (*Proc. nat. mus.*, vi., June, 1883.)
S. I. S. [257

VERTEBRATES.

Development of muscle fibres and their union with nerves. — Although very numerous researches have been made on the differentiation of striped muscles, and on the termination of their motor nerve-fibres, yet the multifarious observations have often been too incomplete to lead to any but conflicting and unsatisfactory theories. An important contribution toward reducing this unfortunate and excessive confusion to order is made by L. Bremer, who has studied the post-embryonic changes in lizards, frogs, and mice. The nucleus of the muscle-fibre, together with the protoplasm surrounding it, constitutes the so-called muscle-corpuscle; the corpuscle is much more prominent in young than in old muscles, for its protoplasm is gradually differentiated into muscular substance; a small number of corpuscles enters into the formation of each fibre; the substance of the muscle forms a network, which was first partially recognized by Heitzmann (*Wien. sitzungsber.* xvii. abth. 3, 1873); the meshes of this network appear polygonal in transverse, rectangular in longitudinal sections; the network is a modification of the protoplasmatic network of the corpuscles, and is so arranged that there are alternating rows, both transverse and longitudinal, of fine knots and large knots (corresponding to the fine and broad striae); the fine knots are connected by fine threads, and the large knots by coarse threads; hence there is a fine and a coarse net.

The post-embryonic multiplication of fibres takes place by means of the structures described by Margo (*Wien. sitzungsber.* xxxvi. 229) under the name of 'sarcoplasten;' there are lines or chains of muscle-corpuscles, united by the protoplasm net, and derived by proliferation from the corpuscles of the original fibres; the sarcoplast gradually separates from the parent fibre, undergoing muscular differentiation meanwhile, and also becoming connected with the nerve. The growth of the fibre is initiated by a multiplication of the corpuscles; the sarcolemma is not present at first, but appears later, being probably formed by the fused cell membranes of the corpuscles, to which appears to be added a coat of connective tissue, and also around the motor plate between the two sarcolemmic coats, an extension of Henle's sheath of the nerve.

The motor nerve plates are formed as follows: When the sarcoplast begins to change to muscle, the nerve grows towards it until the two meet and unite. In lizards only a single nerve-fibre, in the frog and mouse several together, thus approach the future muscle. At the point of contact, the muscle-corpuscles change, so that an accumulation of protoplasm and a proliferation of nuclei occur there. These accumulations were first described by Kühne under the name of 'muskelspindeln' (*Virchow's arch.*, 1863, 116), and are mentioned by many subsequent writers: Bremer now shows that they are young 'end-plates.' Into these the ramifications of the nerve penetrate, after the medullary sheath has been lost. The details of the process, of course, vary in different animals, as do also the final forms of the motor plates.

Besides the motor terminations, there are others, which the author believes to be probably those of the sensory nerves. The fibres running to them are either small and medullated, or naked and end in ramifications upon the muscle, without any conspicuous collection of nuclei and protoplasm at the place of junction. The smaller nerve endings occur on the same fibres with the motor plates, and probably both exist on every fibre. The smaller endings, Bremer designates as 'enddolden' in contradistinction to the 'endplatten.' (Sach's paper on the sensory nerves of muscles is not cited by Bremer.)

Hensen has advanced the view that the connection between the nerves and the peripheral cells exists from the first in the embryo, and that, as the cells divide, so do the nerves. Bremer's observations show that with muscles this is not the case. Moreover, Kleinenberg's theory of the evolution of muscle and nerve must be at least modified, if not set aside. (That the union of the nerve-filament with the peripheral organ is secondary, is shown also by His, SCIENCE, i. 956.) — (*Arch. mikr. anat.* xxii. 318.)
C. S. M. [258

ANTHROPOLOGY.

Folk-lore in the Panjˆb. — Mrs. F. A. Steel is collecting the folk-stories among the natives in the Panjâb. No. 18 is a charming shepherd-tale common among the cattle-drover's children in the forests of the Gujrânwâlâ. It is about Little Ankle-Bone. Once upon a time a little shepherd was eaten by a wolf, that hung the ankle-bone of his victim to a tree. Some robbers, dividing their spoil, were startled by the falling of the bone, which became a little lad, and did many wonderful things, taming all the beasts of the field, and fowls of the air. He changes a pond into milk, by the side of which he sits under an oak-tree, playing his shepherd's pipe, while all the animals come to listen, and to drink out of his marble basins. The series will be continued. — (*Indian antiquary*, xii. 105.) J. W. P. [259

Lorillard City. — After his researches at Chichen-Itza, M. Charnay made an excursion into the country of the Lacandones, — a fierce, indomitable tribe, of whom it is most desirable to have more information.

M. Charnay found the ruins of an ancient city, which he named after his generous patron. In his explorations here, he was assisted by a young Englishman, Mr. Alfred Maudslay, with whom he shares the honor of discovery. The town is about 17° N., on the left bank of the Usumacinta, on the boundaries of Guatemala and the two Mexican provinces of Chiapas and Tabasco. The ruins resemble those of Palenque in the material, arrangement of interiors, decorations, and glyphs. The great stone slabs of Palenque carved with inscriptions and bas-reliefs, are replaced here by lintels covered with superb sculpture (cf. i. 1008.) — (*Proc. roy. geogr. soc.*, v. 44.) J. W. P.

[260

Shaking towers. — Col. Lovett, in his journey through northern Persia, visited the shrines of some dervishes, near which is a minar, curious for possessing the same property that makes the shaking towers of Ispahan famous. When shaken by a man standing on the top, it oscillates sufficiently to cause a brick placed on the edge of the cornice to fall. It is about thirty-five feet high, and six feet diameter at the base, tapering gently upwards. This property of vibrating is attributed at Bostam, as it is at Ispahan, to miraculous interposition of the local saint. It is, of course, due to the elasticity of the bricks and cement used, the latter becoming more elastic with age. — (*Proc. roy. geogr. soc.*, v. 80.) J. W. P. [261

Explorations in Guatemala. — Mr. A. P. Maudslay, mentioned in M. Charnay's researches, has published separately some of his own personal explorations, with a map and ground-plans. Starting from Livingstone, Guatemala, he first visited Quirigua, whose ruins consist of raised mounds and terraces, usually faced with stone, and near to these, carved monoliths. The latter are of two kinds: high upright stones, ornamented with human figures and tables of hieroglyphics; and low broad stones, in the shape of some animal. The first named measure three to five feet across, and 12 to 25 feet out of the ground. On both back and front, the principal ornament is a human figure in relief, decked out in the barbaric splendor usual throughout Central America. Mr. Maudslay suggests that the inevitable human face on the thorax may explain the function of the great number of masks from this quarter. The second class of carvings is very interesting. One specimen, weighing about eighteen tons, represents a turtle having a human head, with projecting ears richly ornamented. In place of the tail is the life-sized figure of a woman sitting cross-legged, and holding a manikin sceptre in her hand. The whole surface of the block is profusely ornamented. Nowhere in the neighborhood are there traces of houses. The exploration at Quirigua led to an attempt to fix the site of Chaciyal, mentioned by Cortez.

Leaving this spot, Mr. Maudslay visited Copan, where the sculptures impressed him as being above those of Quirigua in execution. From Copan our traveller wandered next to Tikal, north-east of Lake Peten, only once before visited by a foreigner, Bernoüilli. All the houses here are built of stone, and coated with plaster. Inside, the walls are seven to eight feet high, and the stone roof forms a narrow gable. The rooms within are very narrow, resembling long passages. The town was laid out in a rectangular form, the slopes terraced with sustaining walls. The houses are often built on raised foundations, stone-faced in the same manner. The most imposing buildings are the five temples raised on pyramidal foundations, in front of which are steep stairways leading up to the doors of the temples. There is no trace of any idol or object of worship in these buildings, but carved slabs and circular altars are found in the plaza. The next point of interest was a ruined town on the Usumacinta. On the top of a steep bank 60 feet high stands the first row of houses, and the town is built on a succession of stone-faced terraces reaching more than 250 feet in height. Instead of the long, narrow interiors as at Tikal, the houses are broken into a number of recesses by buttresses supporting the roof at intervals, and stone is used instead of sapote-wood for lintels. One of the houses at Usumacinta is minutely described by Mr. Maudslay. In nearly all the houses, around the idols, stand earthen pots partly filled with some resinous substance, which the Lacandon Indians probably placed there, showing that the old faith has not died out. At this point Mr. Maudslay met M. Charnay. This very important paper closes with a short sketch of the Lacandones. — (*Proc. roy. geog. soc.*, v. 185.) O. T. M. [262

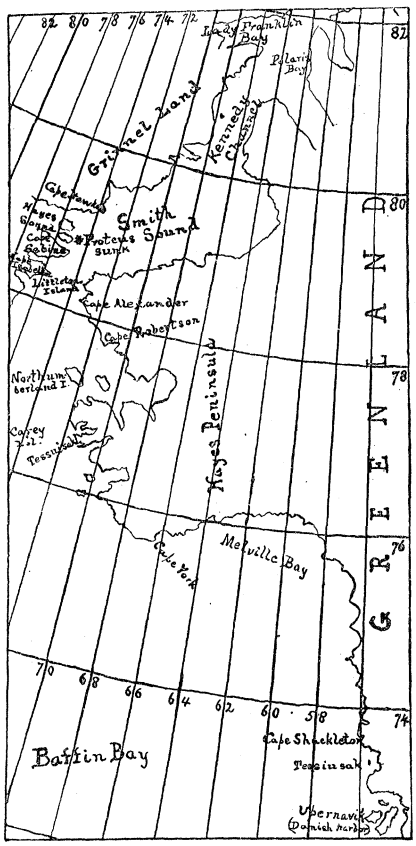
NOTES AND NEWS.

NEWS of a serious character has been received from the Greely relief expedition. The Proteus and Yantic sailed from St. Johns, Newfoundland, June 29. They arrived safely at Disco on the 6th and 12th of July respectively. The Proteus with Lieut. Garlington and the relief party, with supplies, etc., sailed from Disco for Cory island, arriving on the 16th. On the 21st she started for Smith sound, and reached a point in latitude 78° 52′, longitude 74° 25′ W., a few miles north and west of Cape Sabine, where she was beset and crushed in the pack. The party succeeded in saving boats and provisions sufficient to sustain them during their retreat, and made their way across Smith sound and along the eastern shore to Cape York, and reached Upernavik on the 24th of August, all well. Records had been left at Littleton island which apprised the Yantic, on her arrival, of the disaster. A search was immediately instituted, and on reaching Upernavik, Sept. 2, it was found that the Proteus party, after suffering severe hardships, and traversing six hundred miles of the Arctic sea, had arrived in safety. No news was obtained of the Greely party, no supplies had been landed for them, and their situation must be considered as grave. Some rumors had reached the Danish settlements by parties of Eskimo, which, however, are not to be considered as of any weight; and there is yet no reason for supposing that any ill fortune, further than the loss of anticipated supplies, has befallen Lieut. Greely and

his companions. The failure to land supplies was probably due to the conditions of the ice at Littleton island, but nothing can be stated with certainty in advance of more explicit information. The Yantic, with the rescued party, arrived at St. Johns, Sept. 13.

— At a meeting of the Scottish meteorological society, July 26, the following scheme, according to *Nature*, was adopted, looking to the establishment of a zoölogical station in the Firth of Forth: —

It is proposed to enclose the Granton quarry, which has an area at high water of about ten acres, and depths varying to sixty feet, so as to regulate the inflow and outflow of the tide in such a manner, that, while admitting abundance of sea-water at each tide, fish and other animals will be prevented from escaping out of the enclosure. This will be done by means of stakes and wire, with other kinds of netting. The quarry will then be stocked with all kinds of fish and marine invertebrates. When it is desired to separate fish or other animals for special study, this will be done by floating or fixed wire and wood cages.



A barge about sixty-four feet by twenty-seven feet, of great stability, will be moored in the enclosure; upon this will be built a house with laboratories, workrooms, and a library; it will also be furnished with a small windmill to pump up sea-water into a tank on the roof. The water in this tank will be conveyed by pipes to the various tiled tables, glass jars, and aquaria of the establishment. A small cottage will be built on the shore for the accommodation of the keeper and engineer, with one or two spare rooms. A steam pinnace for dredging and making observations in the Firth of Forth and the North sea will be attached to the station.

A naturalist will be appointed whose duty will be to make continuous observations and experiments, assisted by the engineer and keeper. There will be ample accommodation for four other naturalists to work at the station, and carry on investigations; and, so far as the accommodation will permit, British and foreign naturalists will be invited to make use of the station free of charge.

Towards the carrying-out of this scheme, the Duke of Buccleuch has liberally granted a lease of the quarry at a nominal rent, with permission to erect a cottage on the shore. A gentleman who takes a warm interest in the progress of research in Scotland has offered 1,000 *l.* to construct the barge, and fit it up with laboratories and workrooms. Mr. J. Y. Buchanan has promised to fit up one of the rooms on the barge as a chemical laboratory suited to the requirements of the station; Mr. Thomas Stevenson, the society's honorary secretary, has agreed to give his professional services in enclosing the quarry gratuitously; and Mr. John Anderson has undertaken to provide the station with a salmon and trout hatchery. Mr. John Murray will furnish the laboratories with apparatus, and place his large zoölogical library at the service of workers. A number of gentlemen have promised to support the undertaking when once commenced; and it is expected that within a few months the station will be presented with a steam-pinnace and with funds for the erection of a cottage on the shore, — the only desiderata to complete the scheme.

The society granted three hundred pounds for the first year, and two hundred and fifty pounds each for the two succeeding years, toward the expenses of the station. It is expected that by the beginning of November the proper work of the station will be begun. Already several distinguished naturalists have signified their intention to avail themselves of the altogether unique facilities which will be afforded by this zoölogical station for the successful prosecution of biological research.

— In a report on the mineral resources of the United States, during 1882 and the first half of 1883, shortly to be published by the U. S. geological survey, Mr. Albert Williams, jun., has compiled a series of special statistics, of which the following totals will be of interest to our readers.

Omitting the local consumption, there were mined 43,130,863 tons of Pennsylvania anthracite, and 87,963,038 tons of other qualities of coal, including a small amount of anthracite won outside of Pennsylvania; the respective colliery values being $97,044,442 and $109,953,797. Of iron, 1,350,000 tons were mined, worth $44,775,000; while there were consumed in all the iron and steel works, including furnaces, 5,610,000 tons of anthracite and 9,740,000 tons of bituminous coal, 5,130,000 tons of coke, 145,750,000 bushels of charcoal, and 5,800,000 tons of limestone. The product of gold is estimated at $48,750,000, and of silver at $70,200,000. In other words, the mint value of the precious-metal product

was $88,048,239 less than the colliery value of the coal produced during the same eighteen months.

Of crude petroleum, 41,415,163 barrels, valued at $35,010,476, were produced, — a diminishing product with an increasing value; while 149,646,232 pounds of copper were mined, valued in New York at $24,538,091, — an increasing product with a diminishing value.

The lead product was 202,890 tons, worth in New York $18,924,550; and of zinc, 51,765 tons, valued at $5,311,620. 75,472 flasks, or 5,873,508 pounds, of mercury were produced, worth in San Francisco $2,100,750. Of nickel, the product in 1882 was 281,616 pounds, worth $209,777, but the reduction-works closed in 1883; while of cobalt, ore and matte, the product for 1882 was valued at $15,000.

Of other metals, there were mined in 1882, 3,500 tons of manganese, with a spot value of $52,500; 2,500 tons of chromium, worth in Baltimore $100,000; and 60 tons of antimony, worth about $12,000. It is stated that a trifling amount of tin ore has been mined, and the production of metallic tin on a small scale begun.

The estimated value of the building-stone quarried in 1882 is $21,000,000; grindstones, $700,000; soapstone, $90,000 (6,000 tons); brick and tile made, $34,000,000; whiteware, $5,000,000; lime, $21,700,000 (31,000,000 bbls.); cements, $3,672,750 (3,250,000 bbls.); pumice quarried, $1,750 (70 tons); phosphates dug, $1,992,462 (332,077 tons); marl, $540,000 (1,080,000 tons); mica, $250,000 (75,000 lbs.); barytes, $160,000 (20,000 tons); asbestus, $36,000 (1,200 tons); and asphaltum, $10,500 (3,000 tons). There were further produced in 1882 and 1883, 9,618,569 barrels (2,693,196,520 lbs.) of salt, valued at $6,480,210; 2,100,750 pounds of borax, worth $562,903; and in 1882, of sodic carbonate, over 1,600,000 pounds; and of copperas, 15,000,000, worth $112,500.

The value of precious stones found in 1882 was, before cutting between $10,000 and $15,000; after cutting, between $50,000 and $60,000. And there were mined 500 tons of corundum, valued at $6,250; 75,000 tons of quartz; and in 1882 and 1883, 687,500 pounds of graphite, worth $55,000.

The total value of the metals produced in the United States, during 1882, is estimated at $219,756,004; and of the non-metallic mineral substances, $234,156,402: making the total mineral product $453,912,406.

No data seem to have been obtained regarding many of the minor mineral products, while in the majority of cases the figures appear to be approximations only. These defects can doubtless be remedied, in the future, by the adoption of better laws and methods for the collection of our mineral statistics.

— Hachette publishes a book of travel by Edmond Cotteau, entitled 'De Paris au Japon à travers la Sibèrie.' It is well illustrated, and, apart from the illustrations, is especially valuable as indicating how unchanged and identical the civilization of old Russia, as seen in Moscow and similar cities, has been transplanted, as it were bodily, to successive and numerous localities stretching from the Ural to the Pacific, and to the borders of the Arctic Sea.

— A dainty and unique little book is published by Charles F. Lummis of Chillicothe, O. It is a miniature quarto, 6.5×7.5 cm. in size, made of twelve leaves cut from the thin paper-like layers of birch bark. Appropriate woodcuts cover the slightly thicker outer pages, while the interior is given to 'Birch-bark poems, vol. ii.,' by the publisher. We cannot say much for the eight little 'poems,' of which only the first, on 'silver-birches,' has any special appropriateness; but the setting is excellent and attractive, and reflects well the taste and skill of the author.

— The *Manchester guardian* of July 18 gives the following report of M. Pasteur's speech at Dôle on July 14, when his fellow-townsmen placed a memorial tablet in the wall of the house in which he was born. The tablet says simply, "Here was born Louis Pasteur, Dec. 27, 1822." M. Pasteur's remarks were as follows: "I am deeply touched by the honor which the town of Dôle has conferred upon me; but permit me, while expressing my gratitude, to deprecate this excess of glory. In rendering to me the homage which is usually rendered only to the illustrious dead you encroach too hastily upon the judgment of posterity. Will it ratify your decision? And ought not you, Mr. Mayor, to have prudently warned the municipal council against so hasty a resolution? But, having protested against this outburst of an admiration which I do not merit, permit me to say that I am touched to the bottom of my heart. Your sympathy has united in this commemorative tablet two great things which have been at once the passion and the charm of my life, — love of science, and reverence for the paternal home. — O my father and my mother! O my dear departed, who so modestly lived in this little house! it is to you that I owe all. Your enthusiasms, my brave mother, you transmitted them to me. If I have always associated the greatness of science with the greatness of the country, it was because I have been full of the sentiments with which you inspired me. And you, my dear father, whose life was as rude as your rude trade, you showed me what patience and sustained effort could accomplish. It is to you that I owe the tenacity of my daily work. Not only had you the persevering qualities which made life useful, but you had an admiration for great men and great things. 'Look above, learn there, seek to rise always,' — this was your teaching. I see you again after your day's labor, reading some story of battle from a book of contemporary history which recalled to you the glorious epoch which you had witnessed. In teaching me to read, it was your care to teach me the greatness of France. Be blessed both of you, my dear parents, for what you were; and let me transfer to you the homage which is today bestowed upon this house. — Gentlemen, I thank you for giving me the opportunity of saying aloud what I have thought for sixty years. I thank you for this celebration and for your reception; and I thank the town of Dôle, which does not forget any of its children, and which has borne me in such remembrance." M. Pasteur's father was a tanner.